DIVISION OF ENVIRONMENT
QUALITY MANAGEMENT PLAN

PART III:

AMBIENT AIR MONITORING
STANDARD OPERATING PROCEDURES

Revision 3

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Section 1

CONTINUOUS GASEOUS MONITORING

I. Overview

This section describes the procedures for operating, calibrating, auditing, and maintaining continuous gaseous analyzers. The following ambient air pollutants are measured by these procedures: carbon monoxide (CO), nitrogen dioxide (NO_2), nitric oxide (NO), oxides of nitrogen (NOx), ozone (O_3), sulfur dioxide (SO_2), ammonia (NH_3), and hydrogen sulfide (H_2S).

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

A. Calibration

1. Purpose

A calibration establishes the relationship between actual pollutant concentration input and the response of the instrument. This relationship is used to convert subsequent analyzer response values to corresponding pollutant concentrations until superseded by a later calibration of the analyzer.

2. Principle and Applicability

Calibrations are performed at the monitoring site by allowing the analyzer to sample a gaseous standard containing a known pollutant concentration. During calibration, the analyzer operates in its normal sampling mode, and the gaseous standard must pass through all filters, scrubbers, conditioners, and other components used during routine ambient sampling, and also as much of the ambient air inlet system as practicable. Each analyzer must be calibrated in accordance with its manufacturer's operation manual and the specific guidance herein provided.

The type and quality of gaseous standards used are specified in 40 CFR 58, Appendix A, Section 2, 40 CFR 58, Appendix B, Section 2, and 40 CFR 50, Appendices C, D, and F. (See also AAM SOP Section 10 below, "Certification of Standards".) The calibration includes a zero (0) concentration and at least three (3) upscale concentrations spread approximately equally over the measurement scale range. Additional upscale concentrations may be necessary to establish the calibration relationship for nonlinear analyzers. Multirange analyzers must be calibrated for all ranges likely to be used.

3. Frequency of Calibration

Calibration of an analyzer is performed at the time of installation. Recalibration must be performed no later than six (6) months after the most recent calibration.

Subsequent to any of the following occurrences, the zero and span drift must be checked (see paragraph III.B below, "Continuous Analyzer Zero and Span Check") to determine whether recalibration is necessary: an interruption of analyzer operation lasting more than a few days; repairs which might affect calibration; physical relocation of the analyzer; or any other indication of significant analyzer inaccuracy.

4. Equipment

a. Source of zero-air (cylinder, scrubber, and oxidizer)

b. Traceable (see AAM SOP Section 10, "Certification of Standards") calibration standards:

i. Permeation tube and connecting tubing (for SO_2, NH_3, and H_2S)

ii. Gas cylinder (for CO (balance air) and NO)

iii. u.v. standard photometer (for O_3)

c. Regulator valves

d. Tubing and connectors

e. Bypass valve to prevent pressurization of analyzer

f. Flow meter

g. Calibrated dilution equipment

5. Calibration Procedure

a. For proper calibration of any analyzer, avoid pressurization of the system by using a vented manifold or "T" fitting. Use of a flow meter on the bypass or vented port of certain pressure sensitive monitors will cause erroneous readings. Follow all applicable calibration instructions in the instrument manufacturer's operation manual.

b. Initiate a flow of zero-air gas through the analyzer. Adjust zero in accordance with the analyzer manufacturer's recommended procedures if necessary. Record the resultant instrument reading.

c. Initiate a flow of a known gas between 0.35 PPM and 0.45 PPM (35 PPM to 45 PPM for CO) through the analyzer. If necessary, adjust the monitor in accordance with the analyzer manufacturer's procedures. Record the resultant instrument reading.

d. Initiate a flow of a known gas between 0.15 PPM and 0.20 PPM (15 PPM to 20 PPM for CO) through the analyzer. Record the resultant instrument reading.

e. Initiate a flow of a known gas between 0.03 PPM and 0.08 PPM (3 PPM to 8 PPM for CO) through the analyzer. Record the resultant instrument reading.

6. The operator records the following information in order to document the calibration and submits it to the Data Manager: type of QC, pollutant, date, time of day, analyzer make and model, analyzer ID number, person doing QC, location or site ID, known gas type (if applicable), known gas name (if applicable), known gas ID number (if applicable), permeation tube ID (if applicable), calibration equipment type (if applicable), calibration equipment name (if applicable), calibration equipment ID number (if applicable), known concentrations, analyzer readings, ambient temperature (if applicable), and ambient barometric pressure, (if applicable).

B. Continuous Analyzer Zero and Span Check

1. Purpose

The zero and span check is actually a two point calibration, but in this document a calibration refers to a four or more point calibration. The zero and span check is employed to verify calibration of a continuous monitoring instrument. Zero and span checks are required and may be used to: provide data to allow analyzer adjustment to correct for zero and span drift; provide decision points for (re)calibration of analyzers; and provide decision points for invalidation of monitoring data.

2. Principle and Applicability

This procedure employs comparing the monitor reading of an artificial test gas zero concentration and an artificial test gas of a pollutant at one (1) upscale concentration between 70% and 90% of the measurement range. The monitor may be adjusted to read more accurately based on this check.

3. Frequency of Zero and Span Checks

After the normal variability of the analyzer has been established, a zero and span check shall be performed at least once every two (2) weeks.

4. Equipment

a. Source of zero-air (cylinder, scrubber, or oxidizer)

b. Traceable calibration standards:

i. Permeation tube and connecting tubing (for SO_2, NH_3, and H_2S)

ii. Gas cylinder (for CO (balance air) and NO)

iii. u.v. standard photometer (for O_3)

c. Regulator valves

d. Tubing and connectors

e. Vented manifold or "T" fitting to prevent pressurization of analyzer

f. Flow meter

g. Calibrated dilution equipment

5. Zero and Span Check Procedure

a. The zero and span check is performed at the monitoring site. The known gas must be certified according to AAM SOP Section 10, "Certification of Standards". When performing this procedure, the operator will comply with the instructions of the manufacturer's operation manual.

b. During this procedure, the analyzer operates in its normal sampling mode, and the gaseous standard must pass through all filters, scrubbers, conditioners, and other components used during routine ambient sampling, and also as much of the ambient air inlet system as practicable.

c. Initiate flow of a zero-air gas through the analyzer. After the monitor reading has stabilized, record the resultant unadjusted zero reading as "unadj zero".

d. The operator may adjust the zero at his/her discretion if the "unadj zero" falls into any of the following ranges:

CO, from -2.5 PPM to 2.5 PPM
Other pollutants, from -0.025 PPM to 0.025 PPM

If an adjustment is made, record the resultant reading.

The operator will perform a multipoint calibration of the monitor if the "unadj zero" falls into any of the following ranges,

CO, less than -2.5 PPM or greater than 2.5 PPM
Other pollutants, less than -0.025 PPM or greater than 0.025 PPM

e. Initiate flow of a known gas between 0.35 PPM and 0.45 PPM (35 PPM to 45 PPM for CO) through the analyzer. Record the known concentration (K) and the resultant monitor reading (R).

f. Calculate and record the percent difference (PD):

$$PD = ((R-K)/K) * 100$$

g. If PD is -15 to +15, the operator may adjust the monitor at his/her discretion. If an adjustment is made, record the resultant reading.

(NOTE: An operator may adjust a continuous gaseous monitor with a PD in the range of $\pm$10 – 15. Professional judgment is utilized, based upon the operator's familiarity with the instrument in question. This practice is employed to prevent measurement variability related to **overadjustment** of the instrument.)

If PD exceeds $\pm$ 15, recalibrate the analyzer.

If PD exceeds $\pm$ 25, invalidate data back to the last valid (span PD from < $\pm$ 15 without adjustment) zero/span check, audit, or calibration. Investigate potential operational problems, and perform necessary maintenance or repairs. Recalibrate the analyzer.

h. All zero and span checks must be documented in a chronological format. Record the following on a span check form: site ID, pollutant, analyzer identification, date, time of day, identification of standards used, name of person conducting the check, identification of other equipment used, unadjusted zero reading, adjusted zero reading (if applicable), known span concentration, unadjusted span reading, and adjusted span reading (if applicable).

C. Troubleshooting

Troubleshooting will be performed according to the manufacturer's operating manual.

IV. Collection of Data Including Operating Procedures

A. Install the monitor following the instructions in the manufacturer's operating manual. Connect the monitor to the data logger following the instructions in the manufacturer's operating manual and the data logger operating manual. The data logger will be set to Central Standard Time throughout the year. Operate the monitor following the instructions in the manufacturer's operating manual.

B. Preventive Maintenance for Continuous Analyzers

1. For all analyzers, preventive maintenance is performed according to the instructions in the analyzer instrument manual provided by the manufacturer. All preventive maintenance actions are recorded.

2. Sampling lines are inspected every month and cleaned annually or when found to be in need of cleaning.

3. Sampling line filters are inspected/replaced at least monthly.

4. For analyzers using selective scrubbers/converters (SO_2, NH_3, H_2S) verify efficiency periodically and replace when necessary.

5. For any preventive or remedial maintenance actions taken, the action is recorded and kept on file. Documentation must include analyzer identification, analyzer location, date of maintenance, name of person who performed maintenance, and type of maintenance performed.

C. Safety Precautions

1. General safety precautions related to electrical hazards must be observed at all times when working with electrical equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electrical equipment in wet conditions, as frequently encountered at field monitoring sites. Electrical equipment should be switched off and disconnected prior to servicing of internal parts. (Note: Some internal adjustments may require the equipment to be switched on.)

2. General safety precautions related to the handling and use of compressed gases must be observed during the calibration and QC procedures for continuous analyzers. Never attempt to use the contents of a compressed gas cylinder without an appropriate pressure regulator. Do not remove valve protector cap until ready to make connections. Keep valve pointed away from yourself and anyone else. Vent valve briefly to clear opening of dirt and debris before making connection. Never hammer on a cylinder valve or use excessive force in opening or closing. After making connections, check for leaks with soapy water. Close cylinder valve and release all pressure from a device before disconnecting. Never apply oil to a compressed gas valve or regulator. Never expose a compressed gas cylinder to a temperature above 125^{o} F. Vent and use compressed gases only with adequate ventilation.

D. H_2S Monitoring

1. Purpose

This procedure provides guidance to monitor hydrogen sulfide (H_2S) concentration in ambient air.

2. Principle and Applicability

Hydrogen Sulfide (H_2S) is an indirect measurement, which is made after thermal conversion to SO_2. The air sample stream is scrubbed of ambient

SO_2, and the converted H_2S is measured as SO_2. This converted concentration represents the ambient concentration of H_2S.

3. Equipment

a. Continuous H2S analyzer (with built-in converter)

b. Plumbing and fittings

E. NH_3 Monitoring

1. Purpose

This procedure provides guidance to monitor ammonia (NH_3) concentration in ambient air.

2. Principle and Applicability

The ammonia analyzer utilizes an indirect measurement in which NH_3 is converted to nitric oxide (NO) by the following chemical reaction:

$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

The measurement of NO is accomplished by the chemiluminescent reaction of NO with ozone.

The air sample stream is measured by a modified NOx monitor, with ambient NO, and NO from the reaction being quantified. A molybdenum converter is continuously in the air stream pathway, providing an ambient NO value (TN). The air stream pathway is periodically switched to flow through the ammonia converter, yielding a total value for ambient NO plus NO from converted NH_3 (TNx). NH_3 is then calculated by subtraction:

$NH_3 = TNx - TN$

3. Equipment

a. Continuous NH_3 analyzer (with built-in converters)

V. Quality Control Sampling.

A. Analyzer Precision Check

1. Purpose

The precision check is performed in order to monitor analyzer performance. Evaluation of precision data, together with accuracy audit data, provides an indication of overall quality of monitoring data.

2. Principle and Applicability

Precision of continuous analyzers is monitored by means of one-point calibration checks at approximately the level of the National Ambient Air Quality Standards (NAAQS) for the appropriate pollutants.

3. Frequency of Precision Checks

Precision checks are performed on the same schedule as, and prior to, zero and span checks (i.e., at least every two (2) weeks).

4. Equipment

   a. Source of zero-air (cylinder, scrubber, and oxidizer)

   b. Traceable calibration standards:

      i. Permeation tube and connecting tubing (for SO_2, NH_3, and H_2S)

      ii. Gas cylinder (for CO (balance air) and NO)

      iii. u.v. standard photometer (for O_3)

   c. Regulator valves

   d. Tubing and connectors

   e. Vented manifold or "T" fitting to prevent pressurization of analyzer

   f. Flow meter

   g. Calibrated dilution equipment

5. Precision Check Procedure

   a. The precision check is performed at the monitoring site. The known gas must be certified according to AAM SOP Section 10, "Certification of Standards". When performing this procedure, the operator will comply with the instructions of the manufacturer's operation manual.

b. During this procedure, the analyzer operates in its normal sampling mode, and the gaseous standard must pass through all filters, scrubbers, conditioners, and other components used during routine ambient sampling, and also as much of the ambient air inlet system as practicable.

c. Perform the precision check prior to the zero and span check, and prior to adjusting the monitor.

d. Initiate flow of a known gas between 0.08 PPM to 0.10 PPM (8 PPM to 10 PPM for CO) through the analyzer.

e. Record the following: site ID, pollutant, analyzer identification, date, time of day, identification of standards used, name of person conducting the check, identification of other equipment used, known concentration, data logger and monitor readings.

f. Submit the results to the Data Manager.

B. Continuous Analyzer Audit

1. Purpose

The performance audit is performed in order to verify analyzer performance. Evaluation of audit data, together with precision check data, provides an indication of overall quality of monitoring data.

2. Principle and Applicability

Performance audits employ the following gaseous standards:

a. zero-air gas

b. 0.03 to 0.08 PPM (3 PPM to 8 PPM for CO)

c. 0.15 to 0.20 PPM (15 PPM to 20 PPM for CO)

d. 0.35 to 0.45 PPM (35 PPM to 45 PPM for CO)

Traceable gases, dilution apparatus, and transfer standards utilized in audits must be <u>different</u> from those employed in other QC procedures. Audit results must fall within 15% of actual values for acceptance.

3. Frequency of Audits

Audits are conducted on a schedule that meets two (2) requirements: each pollutant parameter is audited at least once per calendar quarter, and each analyzer is audited at least once per year.

4. Equipment

a. Use components dedicated to audit procedures whenever possible.

b. Source of zero-air (cylinder, scrubber, and oxidizer)

c. Traceable calibration standards (<u>from different sources than those used for other QC operations</u>):

i. Permeation tube and connecting tubing (for SO_2, NH_3, and H_2S)

ii. Gas cylinder (for CO (balance air) and NO)

iii. u.v. standard photometer (for O_3)

d. Regulator valves

e. Tubing and connectors

f. Vented manifold or "T" fitting to prevent pressurization of analyzer

g. Flow meter

h. Calibrated dilution equipment

5. Audit Procedure

a. Use a different known gas than is used for other QC operations. Perform the audit prior to adjusting the monitor. Whenever possible, audits should be performed by someone other than the regular site operator.

b. The audit is performed at the monitoring site. The known gas must be certified according to AAM SOP Section 10, "Certification of Standards". When performing this procedure, the operator and/or auditor will comply with the instructions of the manufacturer's operation manual.

c. During this procedure, the analyzer operates in its normal sampling mode, and the gaseous standard must pass through all filters, scrubbers, conditioners, and other components used during routine ambient sampling, and also as much of the ambient air inlet system as practicable.

d. Pass the following concentrations of known gas through the analyzer:

a. zero-air gas

b. 0.03 to 0.08 PPM (3 PPM to 8 PPM for CO)

c. 0.15 to 0.20 PPM (15 PPM to 20 PPM for CO)

d. 0.35 to 0.45 PPM (35 PPM to 45 PPM for CO)

e. Record the following: site ID, pollutant, analyzer identification, date, time of day, identification of standards used, name of person conducting the audit, identification of other equipment used, known concentrations, data logger and monitor readings.

f. Submit the results to the Data Manager.

Note: Audit failures shall be addressed as described in AAM SOP 13, Part C.

C. Special Guidance for Episode Monitoring

1. This procedure is intended to provide special guidance for additional QC requirements during air pollution episode monitoring.

2. As defined here, for the purpose of QC, an air pollution episode is any measured ambient air concentration equal to or greater than an Air Quality Index (AQI) of 150. Pollutant concentrations corresponding to an AQI of 150 appear below:

Pollutant	Averaging time	Concentration in PPM for AQI of 150
SO_2	24 hours	0.225
CO	8 hours	11.25
Ozone	1 hour	0.95
NO_2	1 hour	0.450

3. In addition to all other guidance in this document, the following additional

procedures are required for analyzers used for monitoring during air pollution episodes:

a. Continuous analyzer zero and span checks (paragraph III.B above) will be performed at least weekly, for the duration of the episode.

b. A precision check (paragraph V.A above) will be performed immediately prior to each zero and span check.

c. Subsequent to an episode, as soon as possible, each analyzer used for monitoring of the episode shall be subjected to a performance audit (paragraph V.B above).

VI. Preparation and Analysis of Samples in the Field

Procedures for this are given in paragraph IV above.

VII. Transporting, Transferring, and Storing Samples

Pollutant concentration data is automatically transported electronically over the phone line to a central office computer. Records of field activities (calibrations, preventive maintenance actions, precision checks, zero and span checks, and audits) are initialed and mailed or hand carried to the Data Manager. Further details can be found in the AAM SOP Sections 3 and 4 below.

VIII. Data Acquisition and Processing

These activities are described in section three and four of this document (AAM SOP).

IX. Glossary of Technical Terms

See the glossary in Appendix A of the KDHE DOE Quality Management Plan (Part I) and Appendix A of this document, AAM SOP.

X. Checklist of Field Equipment

A. For calibration equipment, see paragraph III.A.4 above.

B. For zero and span equipment, see paragraph III.B.4 above.

C. For precision check equipment, see paragraph V.A.4 above.

D. For audit equipment, see paragraph V.B.4 above.

Section 2

INTERMITTENT MONITORING WITH HIGH VOLUME SAMPLERS

I. Overview

Pre-weighed Filters are exposed to an air flow (approximately 40 cubic feet per minute (CFM)) for a single 24 hour period (from midnight to midnight (CST)) for the gravimetric determination of total suspended particulate (TSP) and particulate matter less than ten (10) microns in diameter (PM_{10}). This sampling is carried out according to a fixed schedule (once every three (3) or six (6) days) established on an annual basis (USEPA sampling schedule). After exposure, the filters are weighed in a laboratory to determine the net weight gain. The net weight gain and the measured flow rate are used to determine the TSP or PM_{10} concentration in the air.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly. For contracted operations, KDHE Field staff will be responsible for all calibrations, maintenance, and QA checks, except as noted in the applicable contract.

III. Calibration and Troubleshooting

A. Purpose

This procedure is employed in order to calibrate HiVol sampler air flow. Orifice calibration units utilized for this procedure are certified by calibration against a positive displacement meter (See Paragraph III.C of Section 10 of AAM SOP).

B. Principle and Applicability

Calibration is performed at the monitoring site. After calibration using a certified calibrator, the air flow is adjusted **(for mass flow controlled samplers only)** to approximate a standard design flow (QS) setpoint. The QS setpoint for each site location is listed on the calibration form. The QS setpoint corresponds to a field or actual flow of 40 CFM (mass flow controlled PM_{10}) and 44 CFM (mass flow controlled TSP) based on the annual average pressure and temperature at the site. The list of QS setpoints is shown in paragraph III.E.4 below.

C. Frequency of Calibration

Each HiVol sampler (TSP or PM_{10}) flow measuring device is to be calibrated with a certified orifice calibration unit:

1. Upon receipt;

2. At twelve (12) month intervals, if not more frequently;

3. After motor maintenance (excluding routine replacement of brushes); and

4. Any time the flow rate device is repaired or replaced.

D. Equipment

1. Certified HiVol orifice calibration unit

2. HiVol sampler

3. Thermometer

4. Barometer

E. Calibration Procedure for Mass Flow Controlled HiVols

1. This procedure is done initially and at least once a year. Perform this procedure on site. On the PM_{10}/TSP Calibration/Audit form, circle calibration, record site ID, type (for example, PM_{10} or TSP), date, person doing the calibration, HiVol motor ID, orifice ID, barometric pressure (P) in millimeters of Mercury (Hg), temperature in degrees Celsius,
T = degrees C + 273,
$F = (P/760) * (298/T)$.

2. Connect the orifice calibrator to the inlet of the sampler. Perform a leak check by plugging up the orifice holes and running the motor. This check will detect fairly large air leaks, but small leaks will go undetected.

3. Install a filter and run the motor for five minutes.

4. Adjust the flow to get four (4) different flow rates for a sampler with a transducer. The standard flow (QS) setpoint should fall between the high and low flow rates chosen. The QS setpoint for each site location is listed on the calibration form. The QS setpoint corresponds to a field or actual flow of 40 CFM (PM_{10}) and 44 CFM (TSP) based on the annual average

pressure and temperature at the site. The QS setpoints in CFM are shown below:

Location	PM10	TSP
Goodland	36.8	40.5
Concordia	39.7	43.7
Dodge City	38.0	41.8
Chanute	40.3	44.3
Wichita	39.7	43.7
Topeka	40.6	44.7
Kansas City	40.5	44.6
Hays	39.0	42.9

5. At each flow, read and record the orifice manometer reading (H) in inches.

6. At each flow, calculate Y = H *F and record Y.

7. At each flow, using the orifice calibration curve and Y, determine QS. Record QS.

8. At each flow, read and record the transducer reading (I).

9. Create a calibration curve of I versus QS.

10. Remove the orifice calibration unit.

11. Adjust the flow so that QS is equal to the QS setpoint (paragraph III.E.4 above) in the table on the calibration form.

12. Record QS and I.

F. Troubleshooting

Follow the procedure in paragraph IV.F.3 below.

IV. Collection of Data Including Operating Procedures

A. Safety note: General safety precautions related to electrical hazards must be observed at all times when working with electrical equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electrical equipment in wet conditions, as frequently encountered at field monitoring sites. Electrical equipment should be switched off and disconnected prior to servicing of internal parts.

B. Purpose

This is a generic procedure for routine operation of a high volume (HiVol) air sampler. Specific manufacturer's instructions and recommendations contained in the appropriate operation manual(s) must also be followed.

C. Principle and Applicability

A HiVol air sampler is utilized to collect 24 hour particulate samples (i.e., TSP: Total Suspended Particulate, or PM_{10}: Particulate Matter $\leq$ ten (10) microns in diameter) by drawing air through a quartz fiber filter. (Glass fiber filters may be used for TSP, but all KDHE HiVol particulate matter samples are collected on quartz filters.)

D. Frequency

Particulate matter sampling is generally conducted every sixth day, according to a pre-determined sampling schedule. Operation is under the control of an electronic timing device which is set for an operating period of midnight to midnight (CST) on the appropriate day.

E. Equipment

1. HiVol sampler
2. Filter element(s), quartz
3. Filter element envelope(s)
4. Transducer chart (if needed)
5. Pen

F. HiVol Operation

1. Removal of Exposed Filter Element

a. Open timer door and move switch to the "on" position.

b. Verify that the HiVol motor and transducer are working properly.

c. Move the power switch to the "Off" position and record the elapsed timer reading on the appropriate envelope. Remove the transducer chart and place in the filter envelope, and install a new chart on the transducer.

d. Remove filter cassette from the sampler and disassemble, folding the filter with the exposed side toward itself and place in the appropriate envelope.

e. Sign or initial the envelope.

2. Installation of New Filter Element

a. Place a new filter in the filter cassette with the identification number toward the support screen. Assemble the cassette (this may be completed prior to visiting the site).

b. Record the site number, filter identification number, the sample date, and the "Start" elapsed time on the filter envelope.

c. Install the filter cassette on the sampler and secure.

d. Verify the timer is set for the correct sample period. Mechanical six or seven day timers may be advanced to the correct time (CST) and/or date by rotating the timer wheel. Consult the operator's manual to reset an electronic timer.

e. Notes: Flow adjustment is made during calibration. Do NOT try to readjust. Handle filters with care! Torn filters, or filters with pieces missing cannot be analyzed.

Be sure to record ALL required data on the appropriate envelope.

Samplers must run between 23 and 25 hours. Contact field staff supervisor if samplers run outside these limits, or if malfunctions are encountered.

3. Preventive Maintenance and Troubleshooting

a. For all analyzers, preventive maintenance and troubleshooting are performed according to the instructions in the analyzer instrument manual provided by the manufacturer. The schedule in the instrument manual is followed. All preventive maintenance actions are recorded.

b. For TSP and PM_{10} samplers, inspect the unit (brushes, motor, housing, and transducer) at six (6) month intervals. As a minimum replace the brushes. Replace other components if needed or desired. Perform a multipoint calibration if anything besides the brushes is repaired or replaced. If only the brushes are changed and no calibration is done, a record of this action is kept. Run the motor at reduced voltage for one half hour subsequent to replacement of brushes to allow them to seat properly. At least one calibration is done every 12 months on each unit.

c. For PM_{10} monitors, disassemble the size-selective inlet (SSI) for access to all impaction areas. Clean thoroughly, and apply oil to the shim at six (6) month intervals. Check all SSI gaskets and cassette gaskets at six (6) month intervals.

d. For any preventive maintenance actions taken, the action is recorded and kept on file. Documentation must include analyzer identification, analyzer location, date of maintenance, name of person who performed maintenance, and type of maintenance performed.

4. Inspection and Voiding of Exposed HiVol Filters

a. Quartz (or glass) HiVol filter elements must be inspected prior to analysis to determine whether all required sample information has been included; and to evaluate the physical condition of each filter to determine suitability for analysis.

b. Reasons to Void Filters

i. Filter torn before or during sampling.
ii. Part of filter missing or hole in filter.
iii. Sampler ran for less than 23 hours or more than 25 hours.
iv. Site unknown.
v. Date unknown.
vi. Flow rate unknown.
vii. Elapsed time unknown.
viii. Tare weight unknown.
ix. More than one filters for the same site and date.
x. Unusual contamination (e.g., bird droppings).
xi. Did not run.
xii. Improper handling of filter or filter improperly installed on sampler.

V. Quality Control Sampling

A. TSP/PM_{10} Precision

1. TSP Precision

Operation of collocated samplers at TSP sites is optional. At each of these collocated sites, one of the samplers is designated duplicate and the other is 'regular'. Each duplicate sampler is to be located more than two (2), but less than four (4) meters away from the regular sampler. At each site the duplicate sampler operates during the same period as the regular sampler.

The results from each sampler are reported to USEPA's AQS with the other precision and accuracy data.

2. PM_{10} Precision

Precision is provided by having at least 15% of sites with collocated PM_{10} HiVols. Even if the official PM_{10} sampler operates more than one in six days, the duplicate sampler operates at least once in twelve days.

The collocated samplers are located at a distance of 2 to 4 meters from the regular sampler. On the days of collocated operation, each sampler will start and stop at the same time. The collocated samplers will be sited and operated according to 40 CFR 58 Appendix A, Section 3.3.

The resulting concentrations from each collocated sampler are reported to EPA AQS.

B. TSP/PM_{10} Audit

1. Purpose

HiVol sampler flow audits are performed to monitor accuracy of air flow data.

2. Principle and Applicability

a. TSP Audit

TSP accuracy audits are performed by directing air flow into the sampler being audited through a certified orifice calibration unit and recording the resultant flow reading. The orifice calibration unit used for the audit is different than that used in normal calibrations. The orifice calibration unit has been certified annually using the Roots meter at the EPA Region VII lab.

b. PM_{10} Audit

PM_{10} accuracy audits are performed by directing air flow into the sampler being audited through a certified orifice calibration unit and recording the resultant flow reading. The orifice calibration unit used for the audit is different than that used in normal calibrations. The orifice calibration unit has been certified using the Roots meter at the EPA Region VII lab.

3. Frequency of Audit

a. TSP Audit Frequency

The flow rate of each TSP HiVol is audited at least once every six months. The result of each audit is reported to EPA AQS.

b. PM_{10} Audit Frequency

The flow rate of each PM_{10} HiVol is audited at least once every six months. Approximately 50 percent of the PM_{10} HiVols are audited each calendar quarter. The result of each audit is reported to EPA AQS.

4. Equipment

a. Certified HiVol orifice calibration device

b. HiVol sampler

c. Barometer

d. Thermometer

5. TSP/PM_{10} Audit Procedure

a. Use a different orifice calibrator than is used for routine calibration.

b. On the PM_{10}/TSP Calibration/Audit form, circle audit, record the site ID, the type (for example, PM_{10}, TSP, or PM_{10}A), the date, the person doing the audit, the orifice ID, the barometric pressure (P) in millimeters of Mercury (Hg), the temperature in degrees

Celsius, T = degrees C + 273.
F = (P/760) *(298/T).

c. Connect the orifice calibrator to the inlet of the sampler. Perform a leak check by plugging up the orifice holes and running the motor.

d. Install a filter and run the HiVol in normal sampling mode for five minutes.

e. Read and record the orifice manometer reading in inches (H).

f. Calculate Y = H * F. Record Y.

g. Using the orifice calibration curve and Y, determine QS. Record QS.

h. Read and record the HiVol reading (I).

i. Using the HiVol calibration curve and I, determine the HiVol QS (HQS). Record HQS.

j. If QS (for volumetric flow controlled samplers, use sampler corrected flow) is not within 10% of the design flow setpoint, then take corrective action. Record any corrective action.

k. If QS is not within 10% of HQS, then take corrective action. Record any corrective action.

C. Flow Rate/Design Flow Rate Check

A flow rate/design flow rate check is performed on each PM_{10} HiVol sampler at least once per calendar quarter. This check is performed using the same certified orifice calibrator with which the sampler was last calibrated.

1. Purpose

HiVol sampler flow rate/design flow rate checks are performed to confirm sampler calibration.

2. Principle and Applicability

PM_{10} flow rate/design flow rate checks are performed by directing air flow into the sampler being audited through a certified orifice calibration unit and recording the resultant flow reading. The orifice calibration unit used for this procedure **<u>must be the same</u>** as that used in normal calibrations. The orifice calibration unit has been certified annually using the Roots meter at the EPA Region VII lab.

3. Frequency of Flow Rate/Design Flow Rate Check

   Each PM_{10} HiVol is checked at least once per calendar quarter.

4. Equipment

   a. Certified HiVol orifice calibration device

   b. HiVol sampler

   c. Barometer

   d. Thermometer

5. PM_{10} Flow Rate/Design Flow Rate Check Procedure – Mass Flow Controller

   a. Use **<u>the same</u>** orifice calibrator used for routine calibration of the sampler being checked.

   b. On the PM_{10}/TSP Calibration/Audit form, circle monthly flow check, record the site ID, the type (for example, PM_{10}, TSP, or PM_{10}A), the date, the person doing the audit, the orifice ID, the barometric pressure (P) in millimeters of Mercury (Hg), the temperature in degrees Celsius, T = degrees C + 273.
   F = (P/760) *(298/T).

   c. Connect the orifice calibrator to the inlet of the sampler. Perform a leak check by plugging up the orifice holes and running the motor.

   d. Install a filter and run the HiVol in normal sampling mode for five minutes.

   e. Read and record the orifice manometer reading in inches (H).

   f. Calculate Y = H * F. Record Y.

   g. Using the orifice calibration curve and Y, determine QS. Record QS.

   h. Read and record the HiVol reading (I).

   i. Using the HiVol calibration curve and I, determine the HiVol QS (HQS). Record HQS.

j. If the QS is not within 10% of the QS setpoint, then take corrective action. Record any corrective action.

k. If QS is not within 10% of HQS, then take corrective action. Record any corrective action.

6. PM_{10} Flow Rate/Design Flow Rate Check Procedure – Volumetric Flow Controller

a. Record site ID, date, ambient temperature and ambient pressure on verification form.

b. Place the PM_{10} cassette loaded with a blank filter on the filter support screen, tighten securely.

c. Turn sampler on. Allow sampler to warm up and check for leaks.

d. Connect manometer to the pressure tap on the filter housing and record filter pressure (P_f) in inH_2O on verification form.

e. Turn sampler off and remove the PM_{10} cassette loaded with a blank filter.

f. Place orifice transfer standard on the filter support screen, tighten securely.

g. Turn sampler on. Allow sampler to warm up and check for leaks.

h. With the manometer still connected to pressure tap on the filter housing, adjust the variable orifice valve to achieve the pressure recorded in step # 4.

i. Connect second manometer to the pressure tap on the orifice transfer standard and record pressure (inH_2O) on verification form.

j. Convert P_f as recorded in step # 4 to mmHg and record on verification form.

k. Calculate pressure ratio (P_o/P_a). $P_o/P_a = 1 - (P_f/P_a)$.

l. Using the pressure ratio and ambient temperature, look up the actual flow rate (Q_a) from the look up table supplied with the volumetric flow controller. Record Q_a on verification form.

m. Determine the standard flow rate (Q_{std}). $Q_{std} = Q_a$ (P_a/ 760 mmHg) (298K/ 273 + T_a). Record Q_{std} on verification form.

n. Determine the orifice audit flow rate (=SQRT(orifice pressure*T_a/+P_a)-b/m) and record on verification form.

o. Calculate the percentage difference between the actual flow rate and the orifice audit flow rate (=Q_a-orifice audit flow)/orifice audit flow) and record on verification form.

p. Determine the corrected sampler flow rate by using the percentage difference as calculated in step # 15 and the actual flow rate (= Q_a *((1-percentage difference)/1) and record on verification form..

q. Calculate the percentage difference between the corrected sampler flow rate and the design flow rate (= (corrected sampler flow rate-design flow rate)/design flow rate) and record on verification form.

r. If the corrected flow is not within 10% of the design flow, then take corrective action. Record any corrective action.

s. If the actual flow rate is not within 10% of the orifice audit flow rate, then take corrective action. Record any corrective action.

VI. Preparation and Analysis of Samples in the Field

See paragraph IV above.

VII. Transporting, Transferring, and Storing Samples

Filters are collected in the field following the procedure in paragraph IV above. The operator puts the filter into a custody envelope and the following are recorded on the custody envelope: site ID, date of run, elapsed time of run (and/or start and stop time), average flow rate (and/or the transducer chart is enclosed), and signed initials. The custody envelope (with the filter) is hand carried or mailed to KDHE BAR. Staff in the Air Monitoring Unit (AMU) of the Monitoring and Planning Section (MPS) check the envelope for the correct documentation. They also check the filter to see that is not torn. Then the filters are sent to the KHEL for analysis. After analysis, the filters are sent back to the MPS for storage for at least one year.

VIII. Data Acquisition and Processing

See paragraph D of section 4 of this document (AAM SOP).

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

See paragraphs III.D, IV.E, and V.B.4 above.

Section 3

POLLING OF CONTINUOUS DATA

I. Overview

This section describes the procedures used by monitoring personnel to transfer continuous monitoring data to the central office computer. The Agilaire, LLC ambient air quality data acquisition software (E-DAS Ambient for Windows), on the central office computer, polls the data loggers and stores the data on a database. E-DAS also provides the capability to make several types of reports of the data.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

Calibration is not applicable. Troubleshooting will be performed according to the instructions in the User's Guide and Reference Manual (UGRM) for Agilaire's ambient air quality data acquisition software (E-DAS Ambient for Windows).

IV. Collection of Data Including Operating Procedures

A. Initial Setup

The time used (computer and otherwise) will be CST throughout the year. Connect the modem to the office computer and to the telephone line. Install the Agilaire software following the instructions provided by the manufacturer. Log in to the E-DAS and follow the instructions in chapter 2 of the UGRM. Configure the E-DAS system according to instructions in chapter 3 of the UGRM. Configure the security system of E-DAS according to the instructions in chapter 4 of the UGRM. Configure the site information of E-DAS according to the instructions in chapter 5 of the UGRM. Configure the instrument information of E-DAS according to the instructions in chapter 6 of the UGRM. Note that site and instrument may be copied following the instructions in chapter 7 of the UGRM. Enter the EPA data codes according to the instructions in chapter 10 of the UGRM. Download the configuration information to the data loggers according to the instructions in chapter 11. Configure the E-DAS for automatic polling following the instructions in chapter 12 of the UGRM.

B. Operation

1. Reports and Graphs

The following reports are available on E-DAS: data reports, status reports, minute summary reports, hourly summary reports, daily summary reports, monthly reports, multi-hourly monthly reports, flag reports, data recovery reports, network configuration reports, calibration reports, Air Quality Index (AQI) reports, violation of standards reports, joint frequency distribution reports, meteorological reports, maximum hourly averages reports, frequency reports, non-continuous reports and monthly non-continuous reports. A detailed description of these reports is in chapter 13 of the UGRM. A detailed description of the graphs available is in chapter 15 of the UGRM.

2. Editing Data

When changing data on E-DAS, follow the instructions in chapter 14 of the UGRM. To invalidate data, change the status flag to I. All changes are to be made by designated Planning and Data Unit personnel. If other personnel need data changes to the E-DAS, they will notify the Data Manager of the changes. All changes are documented in the ESC Record Log notebook.

3. EPA AQS Data

In order to transmit data from one E-DAS to another or to transmit data to/from EPA, data is exported/imported in AQS format for subsequent submittal to AQS. Chapter 16 of the UGRM is followed in order to export/import AQS format data.

V. Quality Control Sampling

None will be done since this SOP does not involve sampling.

VI. Preparation and Analysis of Samples in the Field

This is not applicable because no sampling is performed in this procedure.

VII. Transport, Transferring, and Storing Samples

Further explanations are in paragraph IV above. Regular backups of the data are made on CD.

VIII. Data Acquisition and Processing

This is explained in paragraph IV above and section 4 below.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

Computer, modem, E-DAS software and Agilaire system Record Log notebook.

Section 4

DATA MANAGEMENT

I. Overview

This section describes the procedures used by personnel in the office to process the data that come from the field. These procedures can be divided into $PM_{2.5}$ intermittent data, hourly data, quality control (QC) data, PM_{10}/TSP intermittent data, submitting data to AQS, submitting site and monitor information to AQS, calculating local conditions data, and documentation of changes to AQS. This section does not include data polling because it is covered in Section 3 of the AAM SOP.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

This is not applicable because monitors are not used in this section.

IV. Collection of Data Including Operating Procedures

A. $PM_{2.5}$ Monitoring

1. Receipt of Filter Data

Field technicians send filter and interval data via E-mail after sampler is downloaded. The data, (in text format, with the name convention "sampleridf01date" (e.g., 20198f01may4.txt), is then transferred to a folder on the data person's hard drive. The folder name corresponds with the month that the data is collected. Each sampler has a folder in the pm25data folder. There is also a 'raw' folder in each sampler folder.

2. Combine Filter Data

In each raw folder there is a file named "sampleridf01.txt" example: 20198f01.txt. This is the main filter data file that is used to combine filter data from multiple filter data files. This provides a single filter data file with an entire month of sample runs. The process is done by cut and paste operations in Notepad.

3. Visual Check of Filter Data

Open the filter data file, (e.g., 20198f01.txt), in the raw folder and visually check the filter data for the following:

(Note: If any of the below data are missing, incorrect, duplicated, or out of range, write down the sampler id, sample date, and what is wrong with the data and contact the operator for explanations.)

a. Check the 7 digit filter identification numbers and make sure there are no duplicates.

b. Check that the elapsed time is > 23:00 hrs and < 25:00, except on blank samples.

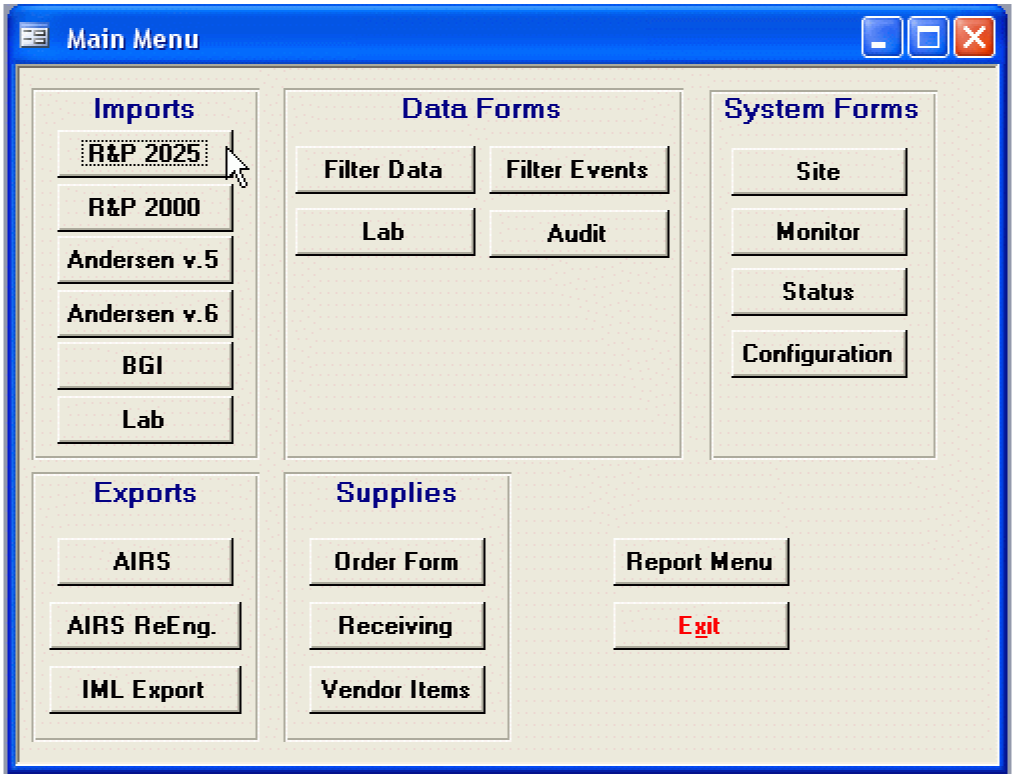
c. Check the average flow. It should be around 16.7.

d. Check the Site ID and Sampler ID (e.g., Site ID 201730010 Sampler ID 20198). If not showing, it will be added later in the process.

e. Check sample dates, according to EPA's Particulate Matter Monitoring Schedule, make sure to note missed sample days, duplicate sample days, etc. This information will be sent to the lab along with the finalized filter data. The interval data files are used to help identify whether a sampler was, or was not running on a given sample day.

4. Data Management

The data management tool used for $PM_{2.5}$ data is the Particulate Data Management Tool (PDMT). The PDMT database was created by the company PES and funded by EPA and Mid-Atlantic Regional Air Management Association (MARAMA). It can be downloaded from http://home.pes.com/pdmt. The program may be run on any workstation that has ACCESS 2000 or a later version installed.



5. Importing $PM_{2.5}$ Data

From the main menu of the PDMT database, look for the Import section and click R&P 2025. This opens the R&P Data Import Form. To import $PM_{2.5}$ data do the following:

a. Enter today's date.

b. Click check box at #1.

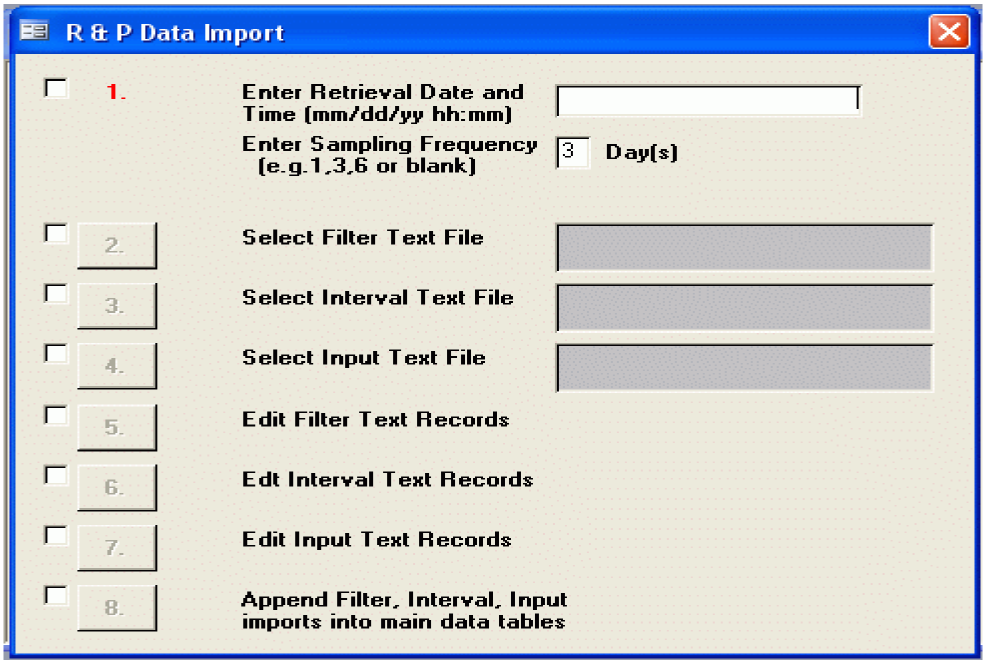
c. Enter Sampling Frequency (i.e., 3 or 6).

d. Click #2 and Browse to sampler filter data in the raw folder.

e. Click #5 Pulls up filter data in table format. This is where editing takes place. Example: site and sampler IDs. Also check the data one last time for duplicate filter IDs, sample dates and times.

f. Click #8 to Append or Add the data to the main data tables.

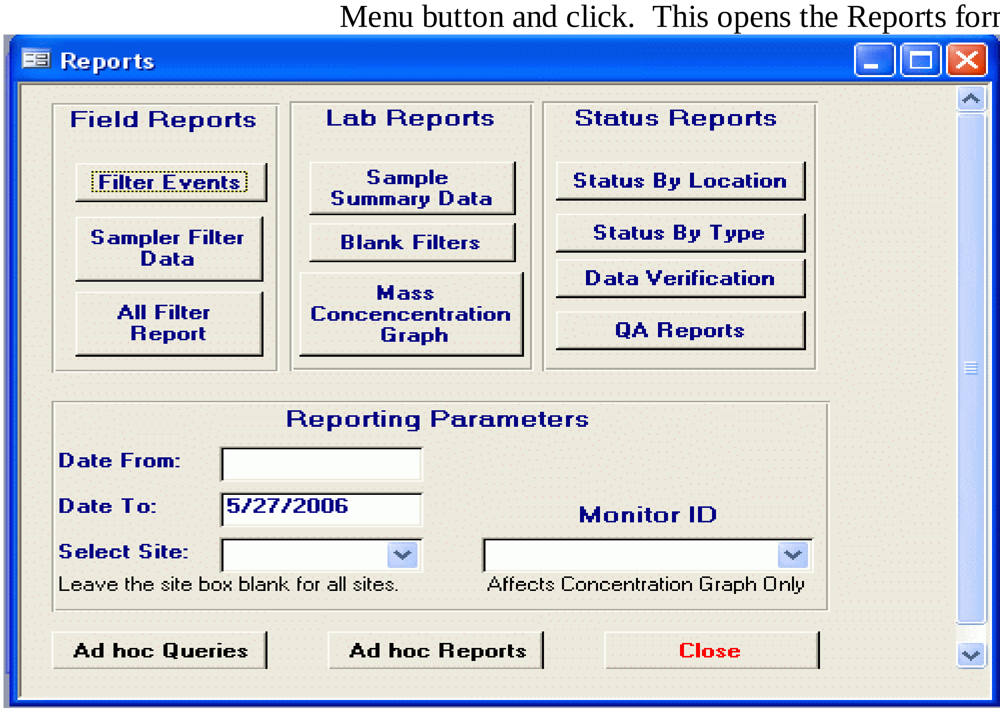
g. Repeat for all samplers, remembering to change the sample frequency when needed (e.g., collocated samplers run on a six day frequency).



6. Editing Query

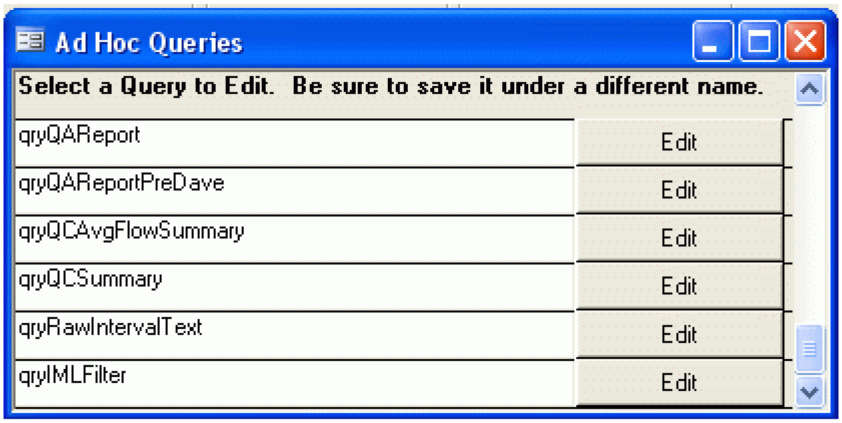
There is a query (qryIMLFilter) set up to create a report of all samplers along with a month of filter data. The query date field needs to be updated to the corresponding month. To edit the query do the following:

a. From the main menu of the PMDT database, look for the Report Menu button and click. This opens the Reports form.



b. Click the Ad hoc Queries button.

c. Scroll and find qryIMLFilter and click edit button.



d. This opens the query in design view. In the FT_Set_Start_Date field, alternate click in the criteria box and scroll to Build. In the expression builder, change beginning and ending dates. Click OK.

e. Run query by choosing the drop down menu under Query heading at the top and scrolling to Run.

f. Save changes and Close query.

g. Close Ad hoc queries form.

7. Printing Report

After editing the query, create a print out of the monthly filter data for a final review. To print the report of filter data from all samplers do the following:

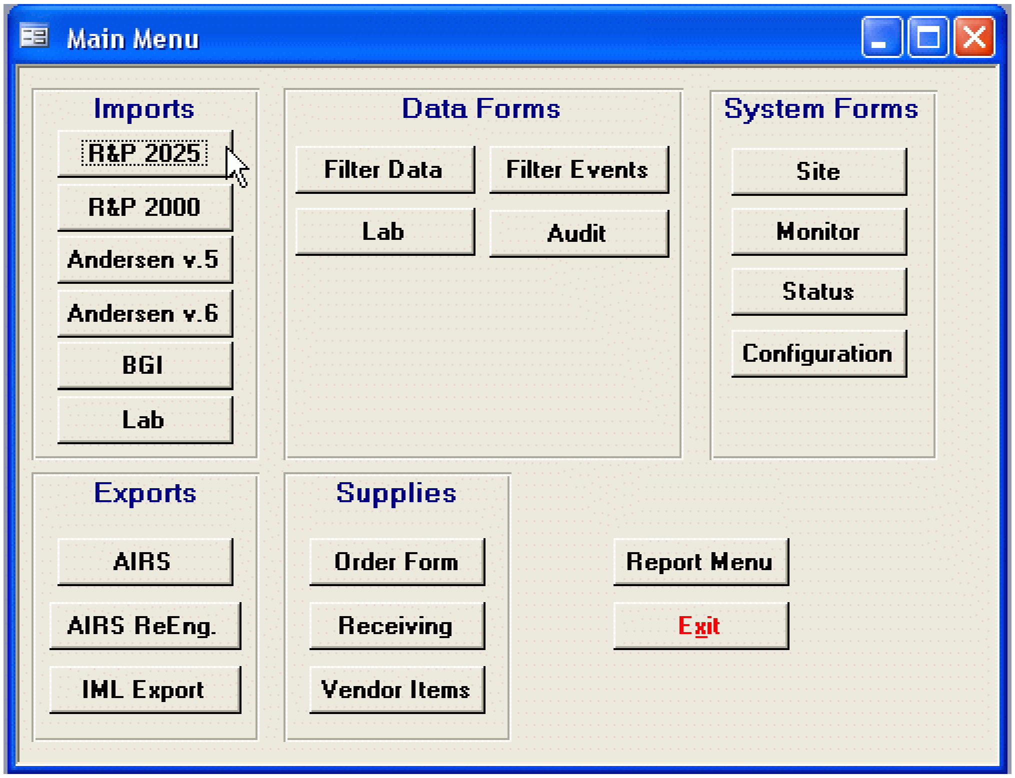
a. In the Reports form, look for the Field Reports section.

b. Click All Filter Report button. This sends the report directly to the default printer.

c. Close Reports form.

8. Final Review

Review report print out one last time for items under Item 3 (Visual Check of Filter Data) in this document. This is also where to summarize all verifications of missing data, voided filters, missed runs, etc., to account for all sampling days for the month according to EPA's Particulate Matter Monitoring Schedule.



9. Create IML File

The filter data file that is sent to the contracted $PM_{2.5}$ lab is created and exported to the hard drive in Microsoft Excel format. The path of the file is located under the IML Export button properties in the design view of the Main Menu. Follow the steps below to export and edit the filter data file:

a. In the Main Menu, click on the IML Export button. You should receive a popup when export is completed.

b. Open the created Microsoft Excel file and make sure each Time referenced column is formatted in 24:00 hour time.

c. Highlight entire file and sort first by column FT_Site_ID2, Ascending, then by column FT_Actual_Start_Date, Ascending.

d. Save according to name convention: (iml_month_year.xls; iml_05_05.xls). Month is equal to the month that the data represents.

10. Send Filter Data to Lab

Send $PM_{2.5}$ filter data to contracting lab via e-mail. Include any information/explanation of voided filters, missed runs, machine malfunctions, etc. Print copy of email, attach with printed All Filter Report, and file.

11. Submission of Filter Data to AQS

a. Once $PM_{2.5}$ filters are analyzed, the contract laboratory provides (via e-mail) Excel and AQS-format text files containing the analytical results.

i. Review the text files for any formatting errors.

ii. Check the Excel summary files to look for any errors or suspicious data.

iii. Check reported contract laboratory results by manual recalculation for three (3) samples chosen at random from the monthly report.

iv. Print off copies of each of the summary files for each site and file in the $PM_{2.5}$/PM_{10} filter file for the appropriate quarter.

v. If high values are reported, notify supervisor.

vi. For any other questions pertaining to the data contact the contract laboratory to determine if data is valid or if re-analysis is needed.

b. Once the Excel file and AQS-format file are correct, save the files and rename for the appropriate year and quarter. Submit AQS-formatted raw data file and then AQS-formatted precision data file to AQS.

B. Hourly Data

1. After the end of each month, perform preliminary editing in EDAS (a and b below). Then print out the monthly reports for all the monitors, select "Forward" and "New Null Code". In Batch Editor, select all the appropriate monitors and the desired time interval.

   a. In EDAS, select "Minimum detectable" and click on "OK". This procedure changes all the negative readings (except temperature) to zero.

   b. Select "Add new AIRS null code" and enter an appropriate null data code ("AM" is a commonly used null data code for "Miscellaneous Void"). Click on "OK". This adds the null code to any hour lacking a valid reading as well as a null code. This procedure can not add null codes when a monitor was not in operation for an entire day.

2. Scan through EDAS monthly reports for errors and suspicious data (high or low). Determine if suspicious data needs to be voided. Document the findings on the corresponding monthly report. Notify supervisor of high values. When looking through the monthly reports conditions as stated below need to be inspected further and could warrant voiding of data:

   a. Values greater than:

      - 7 ppm (CO)
      - 0.070 ppm (other gaseous parameters)
      - 25 mph (wind speed)
      - 360 degrees (wind direction)
      - 80 $\mu g/m^3$ ($PM_{2.5}$ hourly)
      - 50 $\mu g/m^3$ ($PM_{2.5}$ daily)
      - 150 $\mu g/m^3$ (PM_{10} hourly)
      - 100 $\mu g/m^3$ (PM_{10} daily)
      - 42°C (temperature)
      - 100% (relative humidity)
      - 1020 millibars (barometric pressure)
      - 135 Langleys/hour (solar radiation)

   b. Check readings before and after any PC/Span checks (invalid PC/Span checks can lead to invalid data).

c. Several zero values in a row for PM data.

d. Large amounts of missing data (find out the causes by checking with the site operators and by checking monthly reports from site operators, emails, or previous verbal communications).

e. If either wind speed or direction data is invalid, both need to be voided together for the same time interval due to the readings coming from the same met sensor.

f. Check method codes for errors. Any invalid method codes should be changed in EDAS immediately following the replacement of a monitor.

3. Check the QA/QC records, monthly reports from site operators, and emails or verbal communications to determine if additional data should be voided.

4. Correct or delete errors or suspicious data found in steps 2 and 3 in EDAS. Code voided data with the appropriate null data codes. After editing, document the changes in the Agilaire system Record Log book.

5. Create an AQS format data file by either month or quarter. Import the data file into Microsoft Access and run the following queries:

- Record with no value and no null code (when the monitor was not on for a whole day)
- Relative Humidity > 100%
- Wind Speed > 30 mph
- Values (except temperature) < 0

6. AQS will reject any lines of data that meet all conditions stated in Step 5 except for Wind Speed > 30 mph. If the query does not highlight any lines of data that are out of range the file is ready for submission to AQS. If the query highlights data that is out of range, make the appropriate changes to the data and repeat process from step 4 on. Repeat this process until the data passes all queries. At this point, the AQS format file is ready for submission to AQS. Due to the structure of AQS, all AQS format files for raw data (hourly, $PM_{2.5}$ and PM_{10}) must be submitted to AQS before QA/QC data can be submitted.

C. Quality Control (QC) Data

1. Every quarter, store all forms turned in by the field staff in a folder for that specific quarter.

2. Sort all QA/QC paperwork into five categories:

   - Calibration
   - Audit
   - Precision and Span
   - $PM_{2.5}$ Monthly Verification
   - Others

3. Review all forms for errors and make corrections as needed.

4. Enter the dates of all QA/QC procedures into the QA/QC Summary Tables for tracking purposes.

5. Code precision and accuracy data with the appropriate method codes for each form. Enter the precision and accuracy data recorded on the forms by the field staff into AQSPA.

6. In AQSPA, generate and review summary reports for precision and accuracy data. Review these reports for errors or suspect values.

7. In AQSPA, generate AQS format files for precision and accuracy data for the quarter being reviewed. Generation of these files produced AQS-ready files. Due to the format of AQS, files for raw data (hourly, $PM_{2.5}$ and PM_{10}) must be submitted before AQS will accept QA/QC files.

D. PM_{10}/TSP Intermittent Data

1. Filters are collected in the field following the procedure in AAM SOP Sec. 2, paragraph IV. The operator puts the filter into a custody envelope and the following are recorded on the custody envelope: site ID, date of run, elapsed time of run (and/or start and stop time), average flow rate (and/or the transducer chart is enclosed), and signed initials. The custody envelope (with the filter) is hand delivered or mailed to KDHE/BAR.

   a. Technicians in the Air Monitoring Unit (AMU) of MPS check the envelope for the correct documentation. They also visually inspect the filter to determine the suitability of the filter for analysis. After inspection, the status of the sample runs is entered into a database for tracking purposes. Then the filters are sent to the KHEL for analysis. After analysis, the filters are sent back to the AMU/MPS for storage for at least one year.

2. Filters are analyzed at KHEL. Results of filter analysis are emailed to data personnel in the AMU/MPS in Excel format. Review data spreadsheets from KHEL for errors and suspicious data. Notify supervisor if high

values are reported. If errors or suspicious data are found, contact KHEL to inquire about the suspect values or to request reanalysis of the suspect sample(s).

3. Perform a "Sort" to the Excel file. This allows for easy viewing of collocated data.

4. Once all data has been reviewed for errors and incorrect formats, save the files as a *.csv file. After saving, open up the file in Notepad. Choose "Find and Replace" to replace "," with "|". Once all commas are replaced with pipes (|), save the file as a text file (e.g., 2005Qt1PM10). After saving, the file is in the correct format and ready for submission into AQS.

E. Meteorological Monitoring Data

1. A data logger on site stores the data automatically. The central office data computer automatically polls the data logger via modem and telephone line. Meteorological data are averaged over time so that hourly averages are stored for each parameter. The data loggers and central office data computer shall be set to Central Standard Time (CST) throughout the year.

2. Routine Quality Assurance of Meteorological Data

   Routine QA of meteorological data includes components associated with both collection and validation of data.

   a. Data review, screening and validation are conducted on a continual basis. At no time shall more than one month of data be collected without that month's data being reviewed.
   c. Evaluate potential errors (e.g., wind speed above 55 miles per hour, solar radiation above 20 Langleys per hour (LY/hr) at night, relative humidity above 100%, etc.).

   d. Apply criteria in Table 4.1 below. Data outside these ranges or variations will be subjected to further review and evaluation.

Table 1. Screening Criteria for Meteorological Data

Parameter	**Screening Criteria for Further Investigation**
Wind Speed	- is less than zero or greater than 55 miles per hour (mph) - does not vary by more than 0.5 mph for 3 consecutive hours - does not vary by more than 1 mph for 12 consecutive hours
Wind Direction	- is less than 0^o or greater than 360^o - does not vary by more than 1^o for 3 consecutive hours - does not vary by more than 10^o for 18 consecutive hours
Sigma Theta	- is less than 0^o or greater than 90^o
Temperature	- is less than -20°C or greater than 40°C - is extremely cool or warm for the current season - changes by more than 5°C from one hour to the next - does not vary by more than 0.5°C for 12 consecutive hours
Relative Humidity	- is less than 10% or greater than 100% - varies by more than 10% from one hour to the next
Barometric Pressure	- is less than 920 millibars (mb) or greater than 1080 mb - changes by more than 10 mb in 3 hours
Solar Radiation	- is less than 122 Langleys per hour (LY/hr) on a clear, sunny day - is greater than 20 LY/hr at night

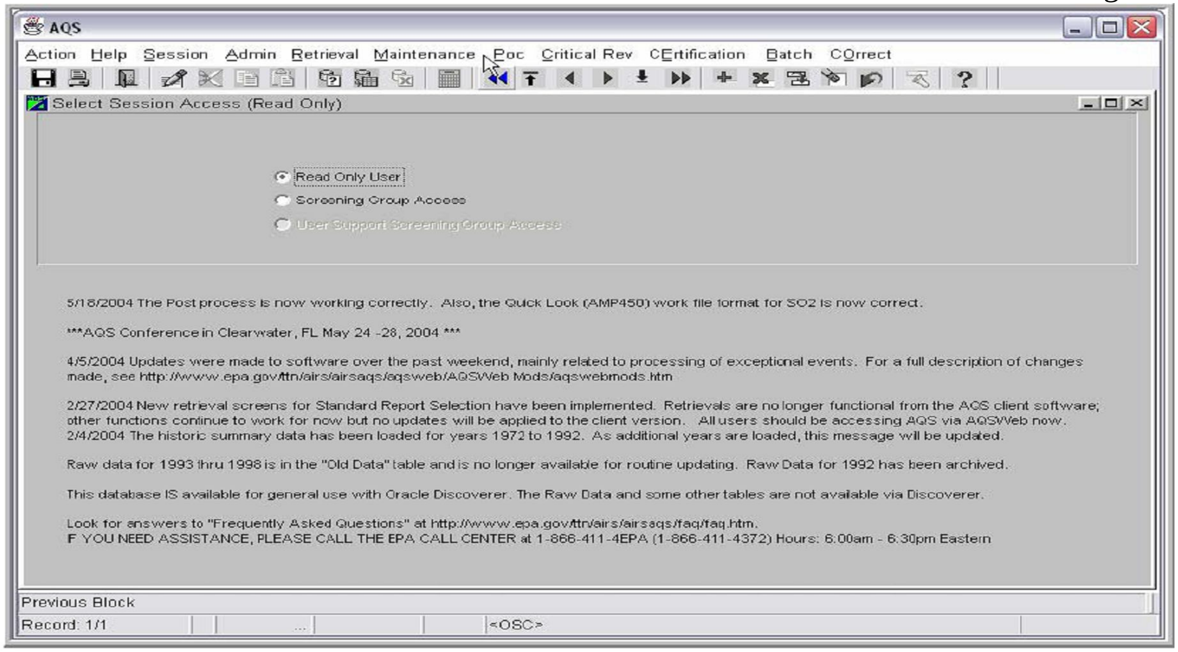
e. Document data validation with initials, dates and notes on paper. Check all data transmitted from one form to another (e.g., field logbook to computer file) to assure accuracy.

3. Raw data are retained on file at KDHE/BAR for a minimum of three (3) years. After this time, hardcopy records and computer backup media may be catalogued by site and boxed for storage.

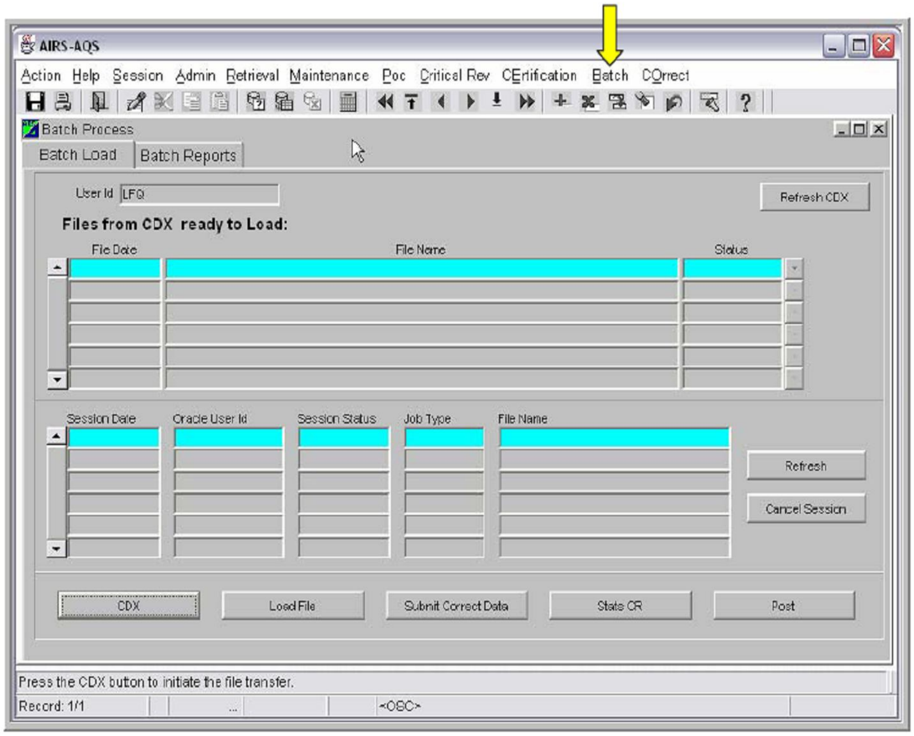
4. All data collected during a calendar quarter shall be spot checked for accuracy.

F. Submit Data to AQS

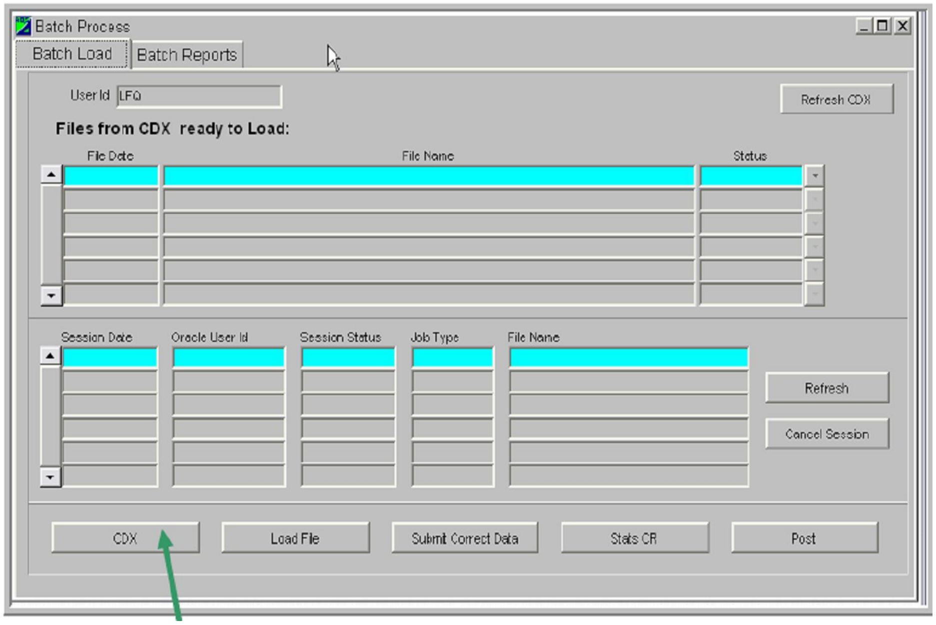
1. On the AQS Logon window, enter the appropriate 3-character userid, your AQS password, and the database name: aqsprod. Press the Connect button. After successfully logging on, the user will come to the "Select Session Access (Read Only)" screen. Select the "Screening Group Access" prompt from the table. Upon Selection, the "Select a Screening Group" screen will appear. Highlight "KANSAS" and click OK.



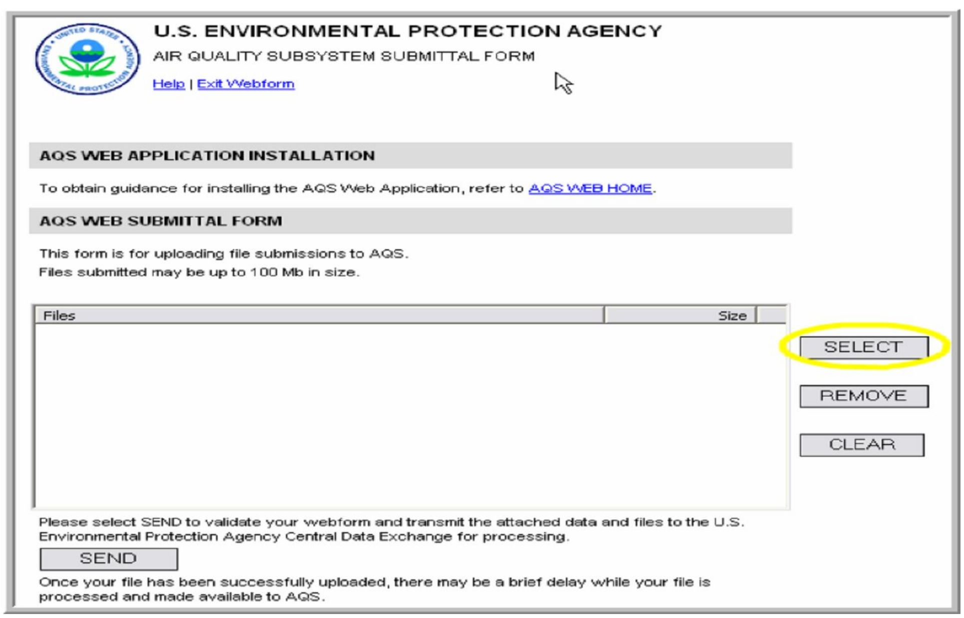
2. Select "Batch" from the Main



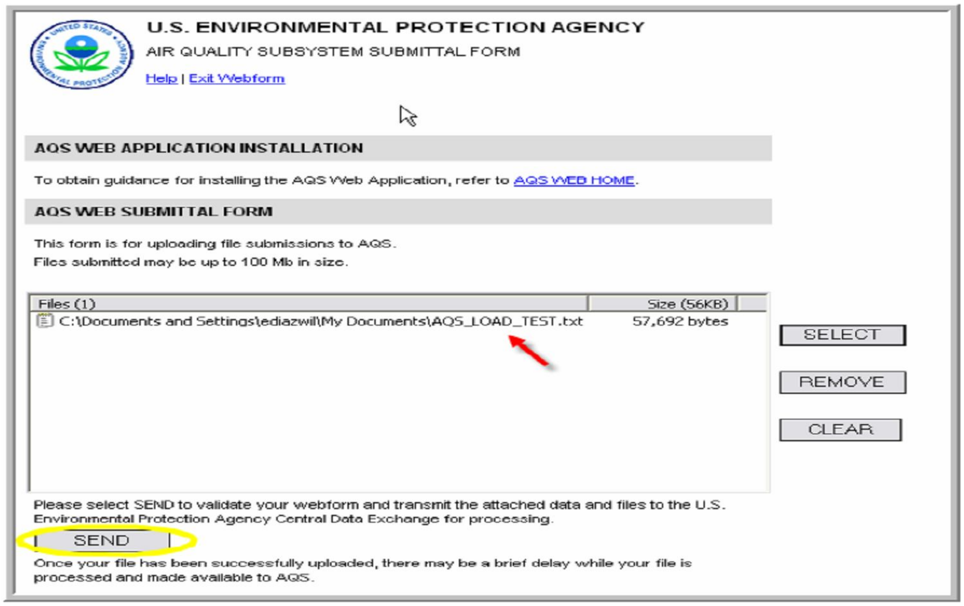
3. Click on "CDX" to go to the CDX log screen.



4. Enter user name and password, and then click the "LOGIN" button. After logging in, the "MyCDX" screen will appear. On this screen, Click the "AQS: Air Quality System-File Transfer" button.

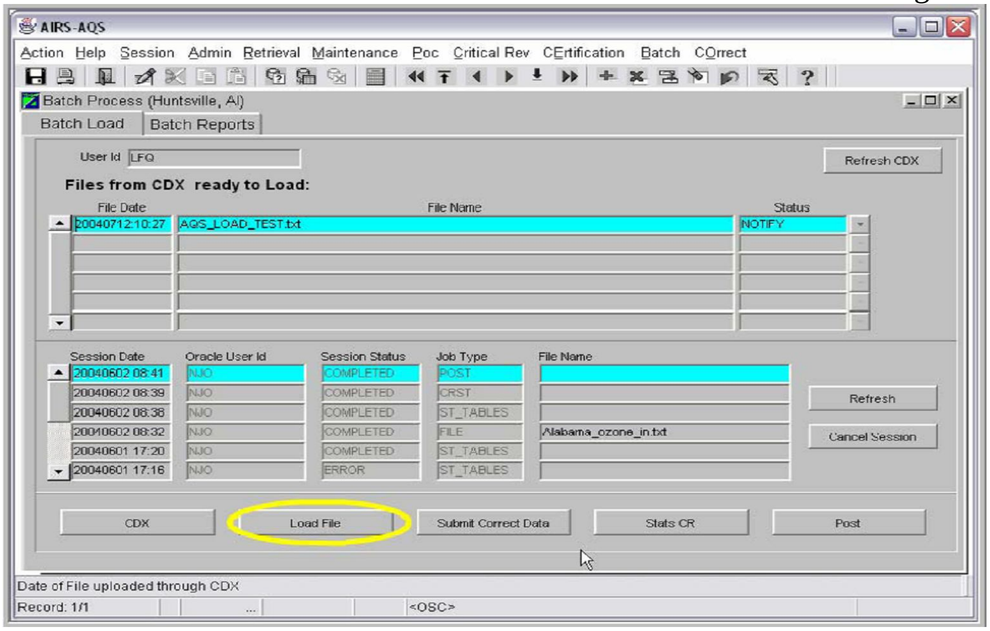


This leads the user to the "AIR QUALITY SUBSYSTEM SUBMITTAL FORM". On this screen, click the select button. This function allows for the user to select the files that will be loaded into AQS. Select the file that you want to load. Click the "Open" button. The file that the user chose will be displayed. When the user has selected all of the files to load, click the “Send” Button.



The user will receive an email message when the files have been successfully transferred to AQS. The user may either upload more files or proceed to AQS to validate and load the uploaded data. The filename will appear in the top of the AQS Batch page when available for loading. The highlighted file will be the one loaded.

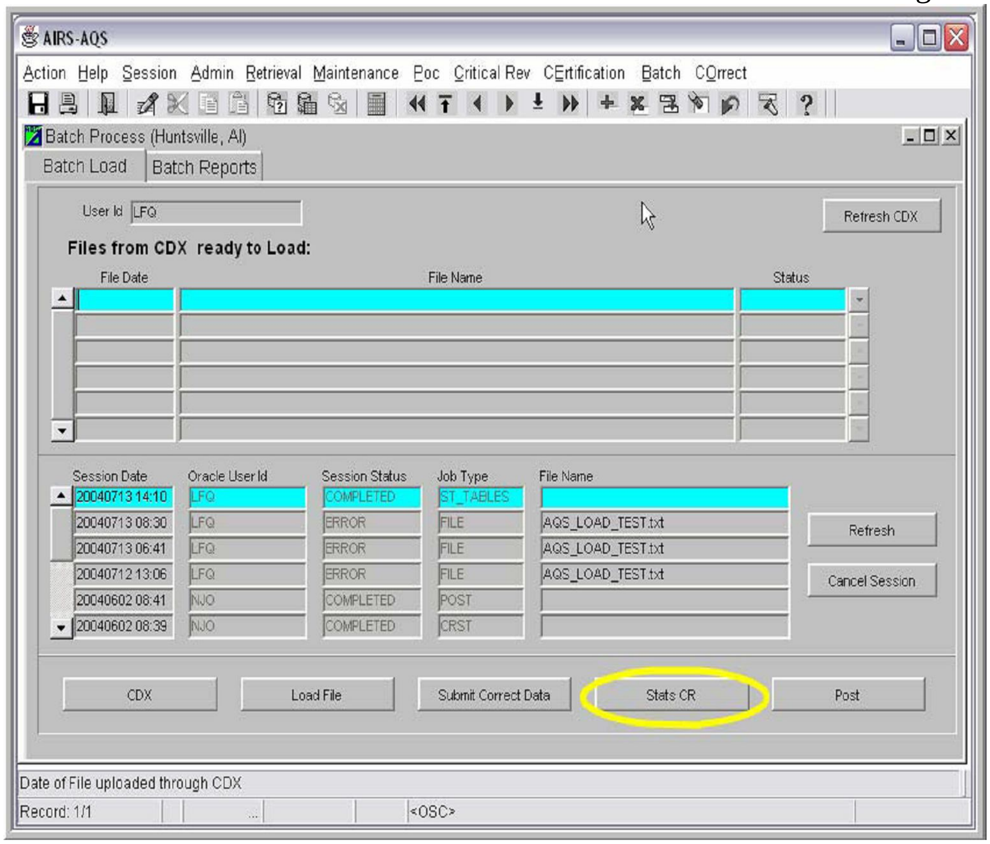
5. Once the data has been transferred from CDX to AQS, go back to the “Batch” screen on AQS. Click the “Load File” button. After loading, an informational window will appear advising that the file has been submitted. Click OK.



6. Use the Refresh button to check Session Status until Session Status is not ‘Active’. If Session Status becomes ‘Completed’ the user may proceed. If Session Status becomes ‘Error’, the user must correct any errors in the file before proceeding. The user should perform an “Edit/Load Summary” and an “Edit Error Detail” and print reports. These reports will inform the user of the locations of the file that are in error. In order to correct errors, the user must select “COrrect” on the main menu and select the appropriate type of data to be corrected (i.e. site data, monitor data, raw data, precision data, accuracy data, etc.). After selecting the data type, the user must execute a query to bring up the lines of data that are in error. The lines of data that are in error will appear. Errors must be corrected, and after all editing has been completed, click the “Save” icon. Return to the Batch menu and click “Submit Correct Data”. At this point, repeat the initial process of step 6. If the Session Status becomes ‘Error’ again, proceed to “COrrect” and perform the necessary editing. If Session Status becomes ‘Completed’, the user may proceed.

7. At this point, valid data other than raw data is posted to production in AQS. Perform an “Edit/Load Summary” and an “Edit Error Detail” report. Print reports and file in the appropriate data folder (QA/QC, hourly). For Raw Data, the user must proceed to the following steps. But for all other valid data, this is the completion of the process.

8. For Raw Data, the user must click the “Stat CR” button from the Batch Load menu.



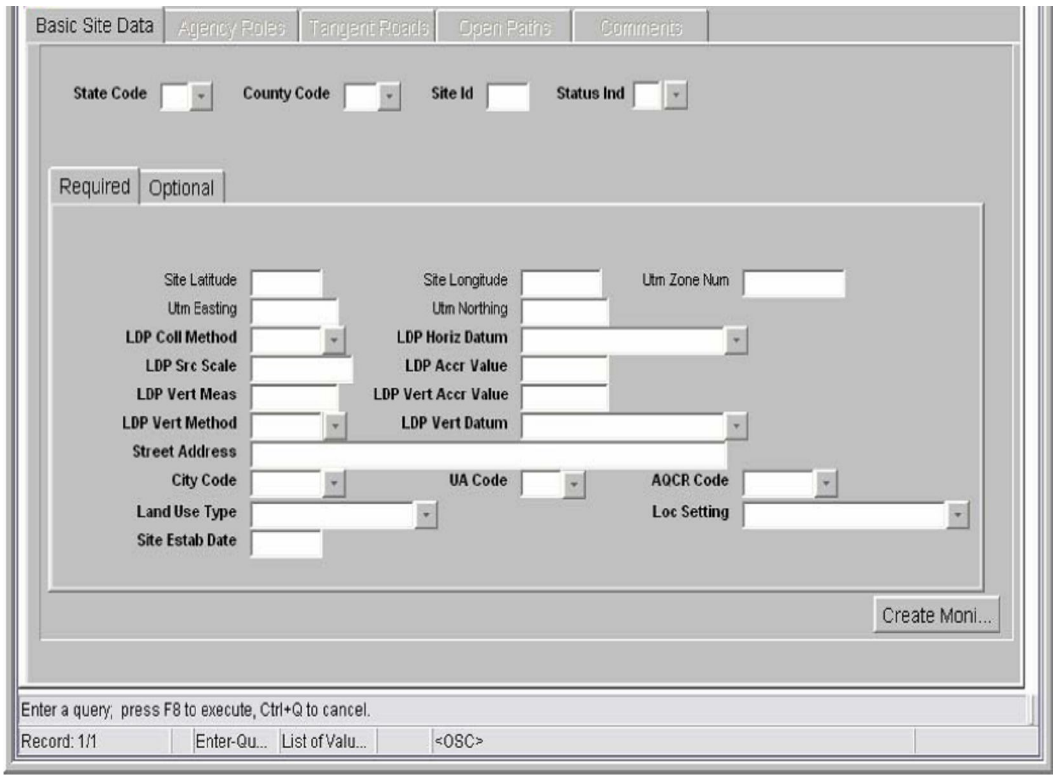
9. After performing "Stat CR", perform "Scan Report" and "Stat Evaluation" from the Batch Load menu. When these functions have been completed select "Post". This will lead the user to the "Review Statistical Data" screen. From here, to post raw data to production status click the "Post Data to Production" button and wait for the confirmation window. After the job is submitted, click the "Return to Batch Processing" button to monitor the progress of this "Post" job. If the session status changes to "Completed", your raw data records are in production on the database. If the job ran and any other status appears, wait for the confirming email to determine the reason for the job failure.

10. After the session status changes to "Completed" for the post, select the "Raw Data Inventory" button. Be sure the session highlighted is for a job type of "post" and the one of interest. Once this function has been completed, the process of loading data into production status in AQS is complete.

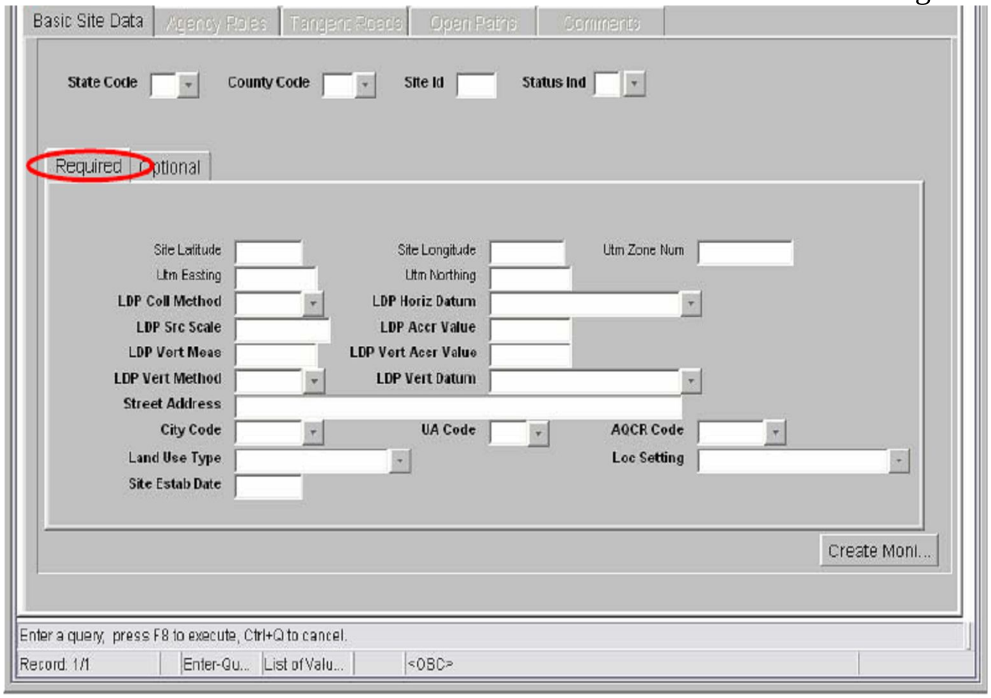
G. Submit Site and Monitor Information to AQS.

1. To add a new site, navigate to the **Maintenance** screen by selecting **M**aintenance and then **S**ite from the **Main Menu**.

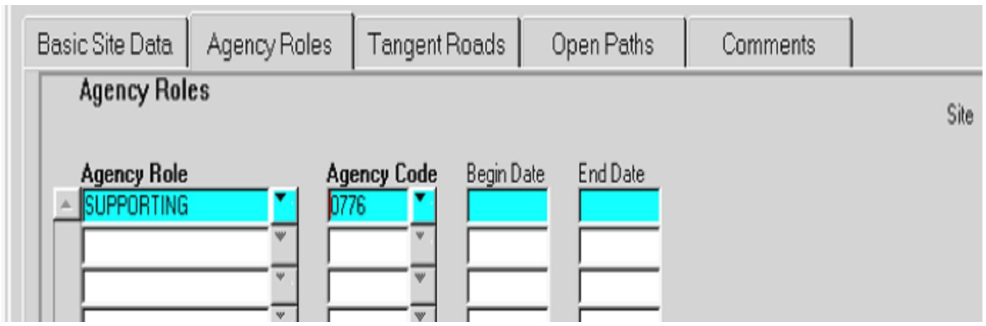
2. All Maintain screens open in Query mode, so the user must click on the "Cancel Query" button to enter data. Enter the appropriate State Code, County Code, and the chosen Site Id. The user may enter the values for state and county directly, or select them from the LOV (drop-down menu located next to the applicable parameters). Using the LOV ensure the value is valid according to AQS.



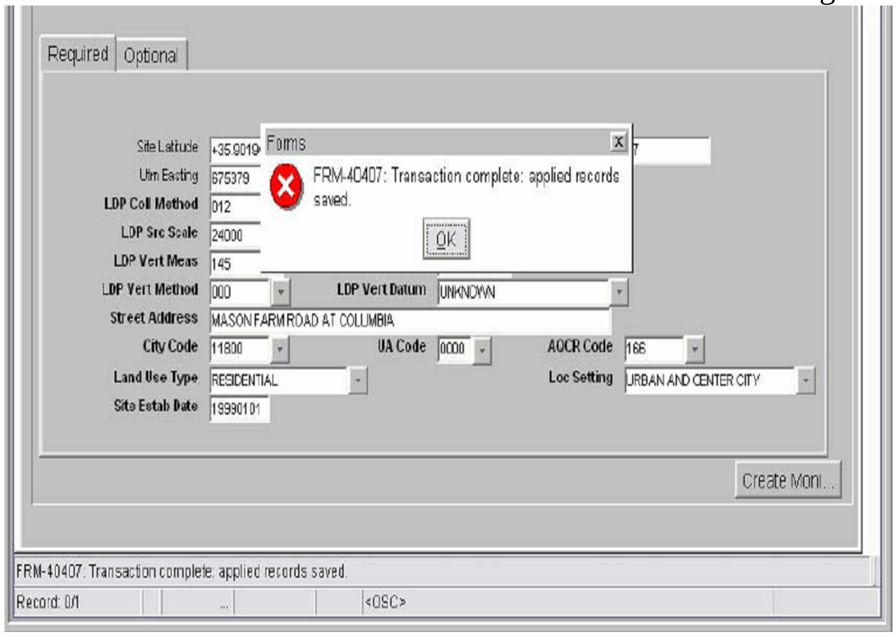
3. Almost all fields on the **Required** tab of **Basic Site Data** are required. The exception is Latitude/Longitude or UTM data. Either Latitude/Longitude or UTM data must be entered, but not both. Select the type of data that is most applicable for the site and enter it into the appropriate box. Leave the **Status Ind** as **F**. When the user has finished the **Required** tab, proceed on to the **Optional** tab to enter Basic Site Data where needed.



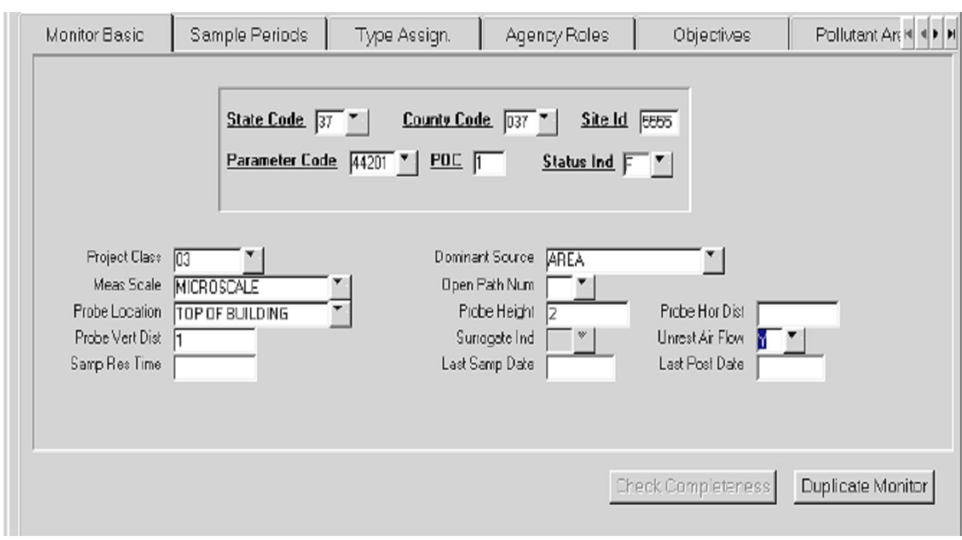
4. Enter a Supporting Agency by selecting the **Agency Roles** tab. A Supporting Agency is required for entry of a new site. Proceed to complete applicable fields for the new site on any other tabs (**Tangent Roads**, **Open Paths**, and **Comments**). If additional information is entered, Tangent Roads, Open Paths, and Comments must be numbered for that particular site. The number that is assigned for that particular site may then be used on the monitor records for that site.



5. When all information has been entered for a site, save the information. Site information at this point is entered completely. To enter monitor data for site, click on the **Create Monitor** button on the lower right section of the **Basic Site Data** screen. At this point, an informational screen will appear indicating that the site transaction is complete and the records have been saved. Click **OK** to continue on to the entry screens for the monitors for the site.



6. Fill in the required fields on the **Monitor Basic** tab located in the top box on the screen (the only remaining empty fields should be Parameter Code and POC). Complete all fields for which information is available. Monitor data covers up to 13 screens of data accessed by the screen tabs. Some of these fields are required while others are not. If the user tries to proceed without completing a required field, the user will receive a warning message about the missing field. For all monitors, Sample Period Begin Data, Monitor Type with a Begin Date, and Monitoring Objective Type are required. PM, SLAMS, NAMS, and PAMS monitors require additional fields. When the user has completed the monitor screens, save the data.



7. If more than one monitor is to be added to AQS, use the **Duplicate Monitor** button to enter remaining monitors as the same site. The user will be prompted for either a new parameter code or a new POC. If the new monitor is for the same parameter but a differing POC, AQS will automatically enter most of the data. The user will be prompted for fields that differ from the original monitor. If the next monitor as the site is for a different parameter, most of the monitor fields will need to be completed. When finished save all work.

Section 5

Training

I. Overview

This section describes the required training of sample collectors, equipment/instrument operators, auditors, data processors, and quality assurance staff.

II. Technical Qualifications

A. Persons evaluating the operation of monitors/samplers must be familiar with the operation of electro/mechanical equipment. Some minor repair and/or adjustments may be necessary.

B. Computer skills are essential for programming many types of monitors/samplers and for problem diagnosis and troubleshooting. Persons operating many types monitors/samplers must have PC (and/or Laptop and/or Palmtop) computer skills to input commands and download data.

C. Working familiarity with electronic and mechanical test equipment and procedures is required in order to troubleshoot and repair samplers.

D. At least two people from each agency (i.e., KDHE and local agencies) are expected to maintain proficiency in monitors/samplers operations and routine maintenance.

III. Calibration and Troubleshooting

This is not applicable.

IV. Collection of Data Including Operating Procedure

A. New Employees

1. New employees (including recent transfers from other programs) shall receive a thorough indoctrination into the QA policies and procedures of the Ambient Air Quality Monitoring Program.

2. The Divisional Quality Assurance Management Policies and Procedures (Part I of the Division of Environment Quality Management Plan), the Bureau of Air and Radiation Quality Assurance Management Plan (Part II), the Ambient Air Monitoring Quality Assurance Program Plans and associated SOPs, shall be required reading on the part of all employees.

3. All new employees shall participate in the orientation seminars offered by the KDHE Personnel Office. New supervisors are also expected to complete the introductory course for supervisors offered by the Department of Administration.

B. Practical Training

1. Self-instructional

   a. The first phase of training is self-instructional. Immediate access to monitors/samplers during this phase is recommended. Printed materials intended for study include the documents listed in paragraph 2 below.

   b. Obtain access to monitors/samplers. This is recommended in order to:

      i. Develop familiarity with the monitor/sampler; and

      ii. Provide initial hands-on experience in preparation for the practical phase of training.

2. Study applicable printed materials which include the following:

   a. 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere;

   b. Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, USEPA, Environmental Monitoring Systems Laboratory, Research Triangle Park, NC;

   c. Operating Manual: Partisol-Plus Model 2025 Sequential Air Sampler, Rupprecht & Pataschnick Co., Inc., 25 Corporate Circle, Albany, NY 12203;

   d. Service Manual: Partisol-Plus Model 2025 Sequential Air Sampler, Rupprecht & Pataschnick Co., Inc., 25 Corporate Circle, Albany, NY 12203;

e. Ambient Air Monitoring Criteria Pollutants Quality Assurance Project Plan, Kansas Department of Health and Environment, Division of Environment, Bureau of Air and Radiation, Monitoring and Planning Section, Topeka, KS;

f. Ambient Air Monitoring Standard Operating Procedures, Kansas Department of Health and Environment, Division of Environment, Bureau of Air and Radiation, Monitoring and Planning Section, Topeka, KS;

g. Ambient Air Monitoring Non-Criteria Pollutants Quality Assurance Project Plan, Kansas Department of Health and Environment, Division of Environment, Bureau of Air and Radiation, Monitoring and Planning Section, Topeka, KS;

h. 40 CFR 58, Appendix A, QA Requirements for SLAMS;

i. Other EPA printed materials as available;

j. Applicable Operator's Manual; and

k. EPA videotapes relating to sampler operation.

3. On-the-job Training (OJT)

a. Overlap of OJT with self-study of printed materials may be necessary and may facilitate learning. OJT provides hands-on experience that is derived from activities in the shop as well as in the field. OJT will be used for all personnel. The trainee will perform the following steps in order to complete OJT for a task.

b. Observe an experienced person doing the necessary task.

c. Study any available operational procedures for the task (See paragraph 2 above).

d. Perform the task under the direct supervision of an experienced person.

e. Repeat the above steps until the supervisor judges the performance of the trainee to be satisfactory.

f. When working in the field with technical equipment and scientific instrumentation, unique problems may arise for which there is no precedent. The solutions to such problems must be achieved through application of paragraph 3.c above in conjunction with consultation with coworkers.

C. Continuing Education

1. The Bureau of Air and Radiation (BAR) maintains a library of educational materials which may be utilized for continuing educational purposes.

2. Continuing educational courses, workshops, or symposia offered by colleges, vocational educational institutions, or various governmental agencies may be attended by appropriate staff. In order for an employee to participate, the subject matter must be applicable to a program or project, funding must be available, and supervisory and administrative approval must be secured in advance.

D. General Field Training Requirements

1. Practical training is emphasized. This includes on-the-job training (OJT) and hands-on experience for each of the following:

a. monitor/sampler operation;

b. data collection;

b. maintenance;

c. calibration; and

d. major repair

2. To ensure consistent operation of all monitors/samplers within the Kansas Ambient Air Monitoring Network, all site operators must demonstrate proficiency in sampler calibration, operation, and data collection to the KDHE Field Technician Supervisor. KDHE/BAR will train, assist, and observe all new operators.

3. The Field Technician Supervisor will randomly accompany site operators to observe their on-site procedures.

E. Health and Safety Warnings

1. General safety precautions related to electrical hazards must be observed at all times when working with electronic equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electronic equipment in wet conditions, as frequently encountered at field monitoring sites.

2. All Ambient Air Monitoring field personnel are required to review AAM SOP Section 18 (Field Personnel Safety). In addition field personnel shall research, present and attend presentations relating to relevant safety issues. Assignments for presentations are made among field staff on a rotational basis. Presentations are made at regularly scheduled work unit meetings. The performance goal is one safety presentation per month.

3. General precautions for working with heavy equipment, and electro/mechanical equipment with moving parts must be observed.

F. Cautions

Although field equipment is manufactured to withstand environmental extremes, it is precision equipment with relatively fragile electronic and mechanical parts. All field equipment used for environmental measurements should be handled with care.

V. Quality Control Sampling

This is not applicable.

VI. Preparation and Analysis of Samples in the Field

This is not applicable.

VII. Transport, Transferring, and Storing Samples

This is not applicable.

VIII. Data Acquisition and Processing

This not applicable.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document and Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

This is not applicable.

Section 6

METEOROLOGICAL MONITORING

I. Overview

This section describes the procedures used by monitoring personnel when measuring the following ambient air parameters: horizontal wind direction (vector average), horizontal wind speed (vector average), standard deviation of horizontal wind direction (sigma theta), temperature, relative humidity, barometric pressure, and solar radiation. The objective of meteorological monitoring is to characterize ambient atmospheric conditions at a location where ambient air quality monitoring is performed.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

Meteorological instruments shall be installed and operated according to the manufacturer's instructions. Troubleshooting and repair of meteorological instruments shall be performed in accordance with the manufacturer's instructions.

Meteorological instruments have been calibrated by the manufacturer.

IV. Collection of Data Including Operating Procedures

A. Siting Guidelines

To meet World Meteorological Organization (WMO) standards, the wind sensor shall be positioned at 9 to 11 meters above ground level on a ten meter tower. The temperature sensor, relative humidity sensor, barometric pressure sensor, and the solar radiation sensor shall be positioned at 3 to 5 meters above the ground. This height requirement is for the following reasons:

1. "Climb guards" which extend from the base of the tower to a height of approximately three meters are installed to limit access; and

2. Local influences associated with the ambient air monitoring equipment shelters are minimized at this level.

There shall be as few obstructions around the sensors as possible.

B. Operation

Operate the monitors according to the manufacturer's instructions. The time of day shall be recorded as Central Standard Time (CST) throughout the year.

C. Maintenance

Each component of the meteorological monitoring system is operated in accordance with the appropriate manufacturer's instrument manual. Specific maintenance for each instrument is described below. Perform preventive maintenance according to the manufacturer's instructions and record all maintenance activities in the station log. Full troubleshooting and maintenance shall be applied as soon as possible to any malfunctioning instrument.

Routine maintenance shall include visual inspection of equipment and verification of operation (i.e., check that data logger is receiving and storing meteorological data) at each scheduled site visit (i.e., every two weeks). Current measurements are to be evaluated to determine whether they are compatible with current conditions. Visual inspection and evaluation of current data against current conditions shall be performed within one week after a severe hailstorm or snowstorm (provided there is safe access to the affected site within one week).

1. Ultrasonic Wind Sensor

   The alignment and overall physical condition of the ultrasonic wind sensor shall be checked annually.

2. Temperature Sensor

   Clean the temperature/humidity sensor radiation shield at least twice per year.

3. Relative Humidity Sensor

   Clean the temperature/humidity sensor radiation shield at least twice per year. Replacement of the humidity sensing element (R. M. Young Co. Part No. 41372-02) at two year intervals is recommended.

4. Barometric Pressure Port and Sensor

   Check the tubing between the pressure port and barometer for condensation at least twice per year, and whenever pressure data appears to be erratic or inconsistent with current conditions. (Note: Installation of a T-fitting and sump can minimize effects of condensation on barometric pressure measurement.)

5. Solar Radiation Pyranometer

Deposition of dust particles on the solar radiation pyranometer window can significantly reduce net solar radiation measurements. Clean the solar radiation pyranometer window with alcohol or water at least twice per year. Recalibration or replacement of the pyranometer shall occur at two-year intervals.

D. Station Log

The station log is essentially a journal which documents all events at the measurement site. Routine site visits, scheduled calibration and maintenance visits, unscheduled maintenance and repairs, and all activities and findings shall be recorded in the station log. The station log provides documentation which may be helpful during data validation.

V. Preparation and Analysis of Samples in the Field

The monitors and data logger automatically measure and record the applicable parameters.

VI. Transport, Transfer, and Storage of Samples

A data logger on site stores the data automatically. The central office data computer automatically polls the data logger via modem and telephone line. The central office data computer shall be set to CST throughout the year. For further details, see AAM SOP, Sections 3 and 4.

VII. Data Acquisition and Processing

The central office data computer stores the data on an Agilaire, LLC data base. For further details, see AAM SOP, Sections 3 and 4.

The Data Manager reviews the data on a quarterly basis, prior to submission to U. S. EPA's Air Quality System (AQS). Potential errors (e.g., wind speed above 100 miles per hour, solar radiation above 20 LY/hr at night, relative humidity above 100%, etc.) are evaluated.

Suspect observations are not always easy to evaluate. Some questionable values may actually be found to result from localized or site-specific effects. The role of experience in any QA-related process cannot, therefore, be overemphasized. Making the correct decisions and taking appropriate actions often depends on the knowledge and experience of technical staff, Data and QA Managers and users of data.

VIII. Glossary of Technical Terms

See the glossary in Appendix A of this document and Appendix A of the KDHE DOE Quality Management Plan (Part I).

IX. Checklist of Field Equipment

Station logbook, data logger, modem, tower, shelter, sensor power supplies, wind sensor, barometric pressure sensor, relative humidity sensor, solar radiation sensor, and temperature sensor.

Section 7

SOIL SAMPLING

I. Overview

A. This section describes the collection of soil samples in the vicinity of an ambient air monitoring site.

B. Soil samples are collected in the immediate area of a TSP, $PM_{2.5}$, or PM_{10} sampler to determine if there is localized reentrainment of soils. Periodic soil sampling at the same site can provide data indicative of accumulation due to airborne particulate deposition on the soil surface from a local source.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

This section is not applicable.

IV. Collection of Data

A. Locate a representative area in the general area of interest. Avoid disturbed areas, areas close to roadways, drainage ditches, close to buildings or equipment storage, under tree drip lines, etc.

B. Collect a soil surface sample approximately three inches in diameter and one/half inch deep and place in container. Repeat collections for 10-15 random sites in an approximate 200 by 200 ft area.

C. Mix soils thoroughly in container. Fill sample bag with composite sample. Write information on sample bag.

D. Samples are identified by a YY/MM/DD/SS number consisting of year, month, day and a sample number. Include City, County and Facility name, and/or AQS site ID number if applicable.

E. Document any special reasons for collecting sample, or analysis requirements. Locate sampling area on a map or make detailed sketch especially if area must be sampled annually as per operating permit.

F. Complete Laboratory Sample Submission form for each sample collected and submit to KHEL in a timely manner.

G. Wipe down equipment between samples to avoid cross-contamination of samples.

V. Quality Control Sampling

None will be done in the field.

VI. Preparation and Analysis of Samples in the Field

See paragraph 4 above.

VII. Transport, Transferring, and Storing Samples

See paragraph IV above.

VIII. Data Acquisition and Processing

Either hard copy or electronic spreadsheets are maintained with data results.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

A. Trowel or scoop for removing soil surface.

B. Inert container for combining several soil samples into a composite sample.

C. Sample bag (KSU soil sample)

D. Pen

E. Sample information form

F. Map/GPS unit for recording/relocating sample site

Section 8

OPERATION OF STAINLESS STEEL FLASKS

I. Overview

This procedure describes the collection of ambient air samples in stainless steel spherical flasks.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

IV. Collection of Data Including Operating Procedures

A. Principle and Applicability

Clean spherical six (6) liter capacity stainless steel flasks can be used to sample ambient air. A grab sample can be obtained by opening a valve on an evacuated flask and subsequently closing the valve when a hissing sound ceases; this generally takes 1 - 2 minutes. Longer fill times (up to several hours) can be achieved through the use of a flow regulator. A larger volume of air can be sampled through the use of a pump which forces air into the sphere, pressurizing the system to nearly 15 psig, equivalent to twelve (12) liters of air at standard conditions.

B. The contracting/EPA laboratory will clean and prepare the flasks.

C. Sampling Procedures

1. Grab Sample

a. Remove protective cap from inlet valve. Measure and record initial vacuum

b. When in position for sampling (e.g., within a plume), open valve about two (2) full turns.

c. Listen for hissing sound; if there is no sound, mark the sphere for return to the shop for cleaning, and start over using another sphere.

d. When hissing sound ceases (within 1 -2 minutes), sampling is complete. Close the inlet valve securely.

e. Replace protective cap on inlet valve. Measure and record final vacuum.

f. Complete all necessary documentation as required by the laboratory.

2. Timed Sample

a. Remove protective cap from inlet valve. Measure and record initial vacuum.

b. Attach a flow controller to the valve, and tighten securely.

c. When in position for sampling (e.g., within a plume), open valve about two (2) full turns.

d. There will be no sound as the sphere fills.

e. Calculate sampling time as:

$$\frac{6000}{\text{cc/min on flow controller}} = \text{minutes to sample}$$

f. When time has elapsed, close the valve securely.

g. Remove the flow controller. Measure and record final vacuum.

h. Replace protective cap on inlet valve.

i. Complete all necessary documentation as required by the laboratory.

3. Pressurized Sample

a. The six liter flasks are filled to 14.7 psig during sampling. This is 12 liters of air at standard conditions. Measure and record initial pressure.

b. Using a valve connected to the pump inlet, set a desired flow rate so that 12 liters are sampled.

c. When the sampling time is complete, close the sample inlet valve.

d. Attach a pressure gauge to the flask. Measure and record the final pressure in psig.

e. Make this calculation:

$$V = \frac{V_1 (14.7 + P_1)\, 298}{14.7\, T_1}$$

Where:

V = The volume sampled at standard conditions

V_1 = Volume of the flask

P_1 = Pressure measured in the flask (psig)

T_1 = Temperature in the flask (K)

f. Record: The starting and stopping time of the sampling, the flask number, the valve number, the valve setting, the flask pressure after sampling, the temperature in the flask, the volume sampled at standard conditions, the location, your name, and the date.

V. Quality Control Sampling

Duplicate (collocated) sampling is recommended whenever possible, depending upon sampling conditions and availability of extra stainless steel flasks. Comparison of results from such collocated samples facilitates evaluation of the precision of the sampling method together with that of the analytical method employed.

VI. Preparation and Analysis of Samples in the Field

See paragraph IV above.

VII. Transport, Transferring, and Storing Samples

See paragraph IV above.

VIII. Data Acquisition and Processing

Either hard copy or electronic spreadsheets are maintained with data results.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

A. Vacuum source and fittings (for evacuation)

B. Cleaned and evacuated spherical stainless steel flask

C. Flow regulator (for timed sampling)

D. Air pump and connecting equipment (for pressurized sampling)

E. Map/GPS unit for recording/relocating sample site

Section 9

$PM_{2.5}$ INTERMITTENT SAMPLING

I. Overview

This section describes the procedures for measuring $PM_{2.5}$ concentrations in the ambient air using Rupprecht & Pataschnick (R&P) Partisol-Plus Model 2025 Sequential $PM_{2.5}$ samplers. Following collection of samples and measurement of flow rates in the field, concentrations are determined by a contracting laboratory by micro-gravimetric analysis. The samplers collect one sample during a 24 hour calendar day, then stop and begin sampling at another day (hence, they are referred to as intermittent). On July 18, 1997 (Federal Register: Vol. 62, No. 138, Friday, July 18, 1997), the United States Environmental Protection Agency (EPA) promulgated a filter-based $PM_{2.5}$ standard (40 CFR Part 50), which requires establishment of a national monitoring network. The state of Kansas, through the Kansas Department of Health and Environment (KDHE), was obligated to adopt the new standard and establish a statewide $PM_{2.5}$ monitoring network. In conjunction with this commitment, KDHE has agreed to participate in EPA's National Contract for the Purchase of $PM_{2.5}$ Monitoring Equipment to fulfill its equipment needs. Under terms of the contract, KDHE selected the Rupprecht & Pataschnick (R&P) Partisol-Plus Model 2025 Sequential Air Sampler as its monitor of choice. This procedure applies only to R&P Partisol-Plus Model 2025 Sequential $PM_{2.5}$ samplers incorporated into the Kansas Ambient Air Monitoring Network.

II. Technical Qualifications

A. All field operations personnel must be familiar with environmental field measurement techniques.

B. Those who service the $PM_{2.5}$ sampler in the field must be very conscientious and attentive to detail in order to report complete $PM_{2.5}$ data of high quality.

C. Persons qualified to perform $PM_{2.5}$ field operations must be able to:

1. Operate the $PM_{2.5}$ sampler;

2. Calibrate, audit and troubleshoot the $PM_{2.5}$ sampler; and

3. Use common methods to determine temperature, pressure, flow rate and relative humidity (RH) in the field.

III. Calibration and Troubleshooting

A. $PM_{2.5}$ Sampler Temperature Sensors Verification and Calibration

1. Summary of Method

a. Three temperature sensor calibrations (ambient air, filter compartment, and filter) should be performed upon installation of the sampler and annually thereafter. Additional temperature sensor calibrations should be performed upon failure of a temperature verification.

b. Ambient air and filter temperature verifications are performed and recorded every 4 weeks to insure specification compliance.

c. Verifications fail when the sampler's temperature measurement system differs by +/- $4^{o}C$ or more from the temperature measured by the temperature standard.

d. Temperature calibrations (ambient air, filter compartment, and filter) are performed upon failure of verifications.

2. Equipment

a. External Thermometer (NIST-traceable minithermometer transfer standard, see AAM SOP Section 10)

b. $PM_{2.5}$ Sequential Sampler

3. Ambient Air Temperature Verification Procedure

a. Ambient Air temperature verification is performed according to the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

4. Filter Temperature Verification Procedure

a. Load an empty (i.e., no filter support screen or filter) filter cassette into sample position.

b. Remove the WINS $PM_{2.5}$ impactor.

c. Determine the current temperature (^oC) at the filter temperature sensor using an external thermometer.

d. Verify that the value of Filt Temp displayed in the Audit Screen is within +/- 4^oC of the measured temperature. If this is not the case, perform the filter temperature calibration procedure described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

e. Remove external thermometer.

f. Remove the empty filter cassette from the sampling position.

g. Reinstall the WINS $PM_{2.5}$ impactor.

5. Temperature Calibration Procedures

a. Temperature calibrations (ambient air, filter compartment, and filter) are performed upon failure of verifications.

b. Temperature calibrations are performed as specified in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

6. Documentation

a. Record the sampler ID, date, person, temperature transfer standard (minithermometer) ID, all readings from the minithermometer, and corresponding temperature readings from the $PM_{2.5}$ sampler.

b. Submit this documentation to the Data Manager.

B. $PM_{2.5}$ Sampler Pressure Sensor Verification / Calibration

1. Summary of Method

a. Perform the ambient pressure calibration upon installation of the sampler, and then annually or when out of specifications.

b. To ensure compliance with specifications, perform the ambient pressure verification (single point) at least every 4 weeks.

2. Equipment

a. A field barometer is used as a transfer standard. For certification of the transfer standard, see AAM SOP Section 10.

b. $PM_{2.5}$ Sampler

3. Ambient Pressure Calibration Procedure

a. Follow the instructions in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

4. Single-point Ambient Pressure Verification

a. Record the pressure value shown on the monitor.

b. Record the transfer standard reading.

c. Compare the values. (The monitor value should be within $\pm$10 mm Hg of the measured ambient pressure. If this is not the case, perform the ambient pressure calibration referenced in paragraph III.B.3 above.)

5. Documentation

a. Record the sampler ID, date, person, pressure transfer standard ID, all readings from the pressure transfer standard, and corresponding pressure readings from the $PM_{2.5}$ sampler.

b. Submit this documentation to the Data Manager.

C. $PM_{2.5}$ Sampler Flow Rate Verification, Calibration, and Audit

1. Scope and Application

a. This procedure is intended for verification or calibration of flow rate for sequential $PM_{2.5}$ samplers in the Kansas Ambient Air

Monitoring Network using a transfer standard.

b. This procedure applies only to Rupprecht & Pataschnick Partisol-Plus Model 2025 Sequential $PM_{2.5}$ samplers incorporated into the Kansas Ambient Air Monitoring Network.

c. The sampler flow rate measurement system must be calibrated using actual (uncorrected) flow rates at ambient temperature and pressure (as opposed to standard volumetric flow rate, which is corrected to standard temperature and pressure).

d. Single point flow rate verifications are performed every four (4) weeks.

e. Multi-point flow rate calibrations are performed at installation of a sampler and annually thereafter.

f. Multi-point flow rate calibrations are performed upon failure of a single point flow rate verification.

g. Failure of the flow rate verification occurs when the sampler's flow rate indicator differs by $\pm$ 4% or more from the flow rate transfer standard.

h. Verification/calibration data are recorded in the site log and reported to the Data Manager on a quarterly basis.

i. A flow rate audit is performed according to the single point flow rate verification procedure (see paragraph III.C.7 below). The flow rate transfer standard used for a flow audit must be different from the transfer standard used for the sampler flow rate calibration. It is preferable (when possible) to have someone perform the audit who did not perform the sampler flow rate calibration.

2. Summary of Method

a. A clean filter is installed in the filter holder.

b. The sample inlet is removed from the downtube.

c. A flow rate transfer standard is connected to the downtube using a flow rate adapter.

d. The instrument flow rate and flow rate transfer standard values are recorded and compared.

3. Cautions

a. Take care to minimize air leaks between the flow rate transfer standard and the sampler inlet.

b. The digital electronic manometer is sensitive to changes in temperature. Limit exposure to thermal gradients, and allow time for thermal equilibration prior to use. Zero the manometer immediately prior to measurement. Obtain measurements as quickly as possible (as soon as a stable reading is obtained).

c. Replace the batteries in the digital electronic manometer frequently, or carry spare batteries when making site visits.

d. Periodic cross-checking the digital electronic manometer against a U-tube manometer is recommended.

4. Interferences

a. Extremely cold temperatures will interfere with the proper functioning of the BIOS DryCal Flow Standard. Follow the manufacturer's recommendation to allow adequate temperature equilibration before use when taking the standard from warm conditions to cold or *vice versa*. The manufacturer's listed operating range for the BIOS DryCal is 0 – 55^{o} C.

b. Wind may cause manometer fluctuations. A wind screen may need to be employed to improve manometer stability.

5. Personnel Qualifications

a. Persons conducting flow rate verification or calibration must be trained in the use of the specific apparatus required.

b. Working familiarity with various types of flow rate standards will be helpful.

6. Equipment

a. The flow rate standard employed should be capable of measuring flows in the range of 15-20 liters per minute. Either of the two (2) following flow rate transfer standards is acceptable:

(1) Streamline Flow Transfer Standard with 10" H_2O electronic manometer; or

(2) BIOS DryCal Flow Standard (not to be used at extremely cold temperatures, i.e., below 0^o C)a. The flow rate transfer standard employed should be capable of measuring flows in the range of 15-20 liters per minute.

b. The transfer standard must be certified. Certification must be NIST-traceable.

c. Annual recertification of the flow rate transfer standard is required. See AAM SOP Section 10 for certification procedure.

7. Single Point Flow Rate Verification Procedure

a. Perform the flow verification procedure described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

8. Multi-point Flow Rate Calibration Procedure

a. Perform the flow calibration procedure described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

b. Reset the sampler flow rate to approximately 10% below the sampler's operational flow rate of 16.67 liters per minute (i.e., approximately 15.00 liters per minute), and repeat the flow calibration procedure.

c. Reset the sampler flow rate to approximately 10% above the sampler's operational flow rate of 16.67 liters per minute (i.e., approximately 18.34 liters per minute), and repeat the flow calibration procedure.

d. After the calibration is complete, perform a single point flow rate verification at the sampler's operational flow rate (16.67 liters per minute).

9. Audit Procedure

a. A flow rate audit is performed according to the single point flow rate verification procedure (see paragraph III.C.7 above). The flow rate transfer standard used for a flow audit must be different from the transfer standard used for the sampler flow rate calibration. The auditor shall be a staff person who did not perform the sampler flow rate calibration.

b. Each sampler will be audited at least once every six months.

Note: Audit failures shall be addressed as described in AAM SOP 13, Part C.

10. Documentation

a. Record the sampler ID, date, person, flow rate transfer standard ID, all readings from the flow rate transfer standard, and corresponding flow readings from the $PM_{2.5}$ sampler.

b. Submit this documentation to the Data Manager.

D. At least 15% of the sites will have collocated samplers. The official sampler is designated the primary sampler and the non-official sampler is designated the duplicate sampler. Each collocated sampler will be located within 1 to 4 meters of the associated regular sampler. The collocated samplers will be sited and operated according to 40 CFR 58 Appendix A, Section 3.5.2.

E. Audits will be performed by KDHE on each sampler at least once every six months. The procedure in paragraph III.C.9 (above) will be followed in these audits.

F. Perform any troubleshooting procedures according to the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

G. Health and Safety Warnings

1. General safety precautions related to electrical hazards must be observed at all times when working with electronic equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electronic equipment in wet conditions, as frequently encountered at field monitoring sites.

2. Refer to Section 2.3 (Health and Safety Warnings) of the EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12, "Monitoring $PM_{2.5}$ in Ambient Air Using Designated Reference or Class I Equivalent Methods".

IV. Sampling Operations

A. Summary of Method

1. The R&P Partisol-Plus Model 2025 Sequential Air Samplers incorporated into the Kansas Ambient Air Monitoring Network have been designated as reference samplers (method designation RFPS-0498-118). These samplers thus meet the requirements for operation in accordance with 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere.

2. The R&P Partisol-Plus Model 2025 Sequential Air Samplers incorporated into the Kansas Ambient Air Monitoring Network are operated in accordance with the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

3. Whenever possible, the R&P Partisol-Plus Model 2025 Sequential Air Samplers incorporated into the Kansas Ambient Air Monitoring Network are operated in accordance with EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12.

B. Safety

1. Persons operating the R&P Partisol-Plus Model 2025 Sequential Air Sampler or cleaning the WINS impactor should review the Material Safety Data Sheet (MSDS) for the WINS impactor oil.

C. Cautions

1. Damage to the $PM_{2.5}$ sampler may result if caution is not taken to properly install and maintain the device. Follow the manufacturer's instructions for maintenance of $PM_{2.5}$ equipment, and for safe, secure installation.

D. Personnel Qualifications

1. All field operations personnel must be familiar with environmental field measurement techniques. Practical experience in the operation and maintenance of the R&P Partisol-Plus Model 2025 Sequential Air Sampler is essential to operation in the field.

2. Persons qualified to perform $PM_{2.5}$ field operations must be able to:

   a. Operate the $PM_{2.5}$ sampler;

   b. Calibrate, audit and troubleshoot the $PM_{2.5}$ sampler; and

   c. Use common methods to determine temperature, pressure, flow rate and relative humidity (RH) in the field.

3. Working familiarity with the R&P Partisol-Plus Model 2025 operating system and software are essential for programming the sampler and for problem diagnosis and troubleshooting.

E. Equipment

1. Rupprecht & Pataschnick Partisol-Plus Model 2025 Sequential Air Sampler

2. $PM_{2.5}$ Teflon filter elements 47mm in diameter. Each should be housed in an appropriate filter cassette.

3. Rupprecht & Pataschnick compatible Palmtop Data Acquisition System (PDAS) or equivalent or laptop computer, appropriate connecting hardware, and appropriate R&P communications and data management software.

F. Method Calibration

1. Calibrate the sampler temperature sensors in accordance with paragraph III above.

2. Calibrate the sampler ambient air pressure sensor in accordance with paragraph III above.

3. Calibrate the sampler flow rate in accordance with paragraph III above.

G. Sampler Operation

1. Operate each sampler in accordance with the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

H. Field Maintenance

1. Summary of Method

a. Perform field maintenance every five sampling days, monthly, and quarterly in accordance with the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual, and table 9-1 in section 9.0 of the EPA Quality Assurance Guidance Document 2.12, "Monitoring $PM_{2.5}$ in Ambient Air Using Designated Reference or Class I Equivalent Methods". This table appears in Appendix F of this document.

2. Cautions

a. Damage to the $PM_{2.5}$ sampler may result if caution is not taken to properly install and maintain the device. Follow the manufacturer's instructions for maintenance of $PM_{2.5}$ equipment,

and for safe, secure installation.

3. Equipment

a. Flow Audit Adapter for external leak check

b. 47 mm Leak Check disk in filter cassette for internal leak check

c. WINS impactor assembly for change out (must be properly cleaned and reoiled)

d. An alcohol-based general purpose cleaner

e. Cotton swabs

f. Small, soft bristle brush

g. Paper towels

h. Distilled water

i. Miscellaneous hand tools

j. Spares (i.e., O-rings, V-seals, silicone grease, etc.)

4. Field Maintenance Procedures

a. Field maintenance procedures are described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual and Table 9-1 in section 9.0 of the EPA Quality Assurance Guidance Document 2.12, "Monitoring $PM_{2.5}$ in Ambient Air Using Designated Reference or Class I Equivalent Methods".

b. Perform external and internal leak checks upon installation of a sampler, and subsequently after every four (4) weeks of operation. These leak check procedures are described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

c. Replace the WINS impactor assembly with a clean one after every five (5) sampling runs. This procedure is described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

d. For each preventive or remedial maintenance activity, record the sampler ID, the date, the person, and the action taken.

I. Filter Handling and Transport

1. Scope and Application

a. For $PM_{2.5}$ monitoring, KDHE/BAR employs Rupprecht & Pataschnick (R&P) Partisol-Plus Model 2025 Sequential Air Samplers which collect fine particulate on 47 mm diameter Teflon filter elements.

b. These filter elements are quite fragile, and $PM_{2.5}$ samples must be protected from contamination and/or analyte loss which may affect analytical results. Special handling is required to ensure the integrity of these samples.

c. This SOP describes handling and transport of $PM_{2.5}$ filter elements.

2. Summary of Method

a. EPA provides unexposed 47 mm diameter Teflon filter elements.

b. The clean filters are sent to the contract analytical laboratory for proper physical inspection, conditioning and determination of tare weights. The primary KDHE/BAR contract specification requires that the contracting laboratory conduct all filter handling in accordance with 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere. Whenever possible, the $PM_{2.5}$ filter elements are also handled in accordance with EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12. Deviations from Sec. 2.12 must be approved by KDHE/BAR per contract. All contract analytical laboratory activities are conducted in accordance with the laboratory's SOPs.

c. After tare weights have been determined at the contract laboratory, filter elements are shipped to KDHE/BAR and to local agencies conducting $PM_{2.5}$ sampling under Memoranda of Agreement with KDHE/BAR. These filters must be exposed within thirty (30) days of determination of tare weight. To minimize opportunities for contamination, it is recommended that filter cassettes be loaded into magazines indoors whenever possible.

d. Filter elements are handled in the field in accordance with 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere and the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

e. Retrieval of exposed filter elements and associated data is accomplished in accordance with paragraph IV.G above.

f. Exposed filter elements are transported to the contract analytical laboratory in equipment meeting the requirements specified in 40 CFR 50, Appendix L, Section 10.13. All sample transportation equipment and/or devices are provided and maintained by the contractor.

g. Post-exposure conditioning and determination of gross weights are conducted by the contract analytical laboratory in accordance with the laboratory's SOPs which must meet the requirements outlined in paragraph IV.I.2.b above.

h. Subsequent to determination of gross weights, the contract analytical laboratory stores all exposed filter elements under refrigeration at $4^{o}C$ for a period of one (1) year.

3. Cautions

a. Teflon filter elements are fragile. Handle with care, and never use damaged filter elements for sample collection.

b. $PM_{2.5}$ samples are subject to contamination which may affect analytical results. Field personnel should not handle filter elements directly, but only when loaded in filter cassettes. Care must be taken to prevent exposure to sources of particulate matter at all times other than sampling. To minimize opportunities for contamination, it is recommended that filter cassettes be loaded into magazines indoors whenever possible.

c. $PM_{2.5}$ samples are subject to loss of sample resulting from volatilization of certain chemical species and/or physical loss of particulate matter.

d. Sample loss due to volatilization is generally controlled by maintaining exposed filter elements at cool temperatures. Temperature control during handling and shipping is extremely difficult, but efforts to avoid exposure to elevated temperatures (i.e., above 4^{o}C) are essential.

e. Physical loss of particulate matter generally results from careless handling of exposed filter elements. This may result from dropping or jarring of cassettes as well as from abrasion of the filter element. Care should be taken to prevent accidental loss of particulate matter.

f. Cigarette smoke is a known source of fine particulate matter. All activities associated with filter handling, transport, and operation of $PM_{2.5}$ airborne particulate samplers must be conducted in a smoke free environment.

4. Equipment

a. Rupprecht & Pataschnick Partisol-Plus Model 2025 Sequential Air Sampler

b. $PM_{2.5}$ Teflon filter elements 47mm in diameter. Each should be housed in an appropriate filter cassette.

c. Rupprecht & Pataschnick compatible Palmtop Data Acquisition System (PDAS) or equivalent or laptop computer, appropriate connecting hardware, and appropriate R&P communications and data management software.

d. (Electro) static-free bags with labels for filter cassettes

e. Mini-cooler with reusable cooling medium and internal temperature monitoring device

f. Large zip-lock bag to hold and protect individual bagged samples in mini-cooler.

g. Ball point pen

5. Sample Collection, Preservation and Storage

   a. Collect and retrieve samples and associated data in accordance with paragraph IV.G above.

6. Sample Handling Procedure

   a. EPA personnel provide unexposed 47 mm diameter Teflon filter elements to the contract analytical laboratory.

   NOTE: Steps 6.b through and including 6.h (below) are performed by contract analytical laboratory personnel.

   The primary KDHE/BAR contract specification requires that the contracting laboratory conduct all filter handling in accordance with 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere. Whenever possible, the $PM_{2.5}$ filter elements are also handled in accordance with EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12. Deviations from Sec. 2.12 must be approved by KDHE/BAR per contract. All contract analytical laboratory activities are conducted in accordance with the laboratory's SOPs. These SOPs are subject to KDHE review.

   b. Conduct physical inspection of filter elements. Do not use damaged or imperfect filters for sampling.

   c. Properly identify each filter (i.e., assign filter I.D.).

   d. Condition filter elements in preparation for determination of tare weights.

   e. Determine tare weights of filter elements. This should be limited to an approximate number that can be exposed within thirty (30) days after weighing.

   f. Perform all required Quality Assurance/Quality Control (QA/QC) activities.

g. Load processed (tared) filter elements into filter cassettes for handling and sampling.

h. Properly package processed filter elements, and ship them to KDHE/BAR and to local agencies conducting $PM_{2.5}$ sampling under Memoranda of Agreement with KDHE/BAR.

NOTE: Steps 6.i through and including 6.r (below) are performed by KDHE/BAR or local agency field staff.

Filters must be exposed within thirty (30) days of determination of tare weight (i.e., the "Use before" date which appears on the filter bag label).

i. Install filters into samplers, loading magazine in accordance with the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual. Load appropriate filter/sample information into sampler memory at this time. (To minimize opportunities for contamination, it is recommended that filter cassettes be loaded into magazines indoors whenever possible.)

j. Initiate the sampler run to expose the filter element to a known volume of air for a designated length of time (usually 24 hours). Particulate matter is collected on the filter element.

k. Immediately prior to retrieval of filter elements, remove cooling medium from freezer. Place in mini-cooler with temperature monitoring devices. (Mini-cooler, cooling medium, and temperature monitoring devices are provided by the contract analytical laboratory.)

l. Retrieve filter elements (in cassettes) and associated data in accordance with the manufacturer's operating manual.

m. Place each filter cassette retrieved in a separate static-free bag (provided by the contractor). Each bag should be custody label-side up, with the sample surface toward the custody label on the bag to ensure that the sample is shipped with the exposed surface upward. Always handle, transport, and/or store bagged samples custody label-side up.

n. Write appropriate filter/sample information on the custody label attached to the bag.

o. Insert large zip-lock bag containing samples, with custody labels facing up, into mini-cooler.

p. Transport mini-cooler to office after retrieval of all filter elements. If filters will not be shipped within two (2) hours, remove cooling medium and secondary container from coolers and place in freezer.

q. Prepare mini-cooler for shipping. Place secondary container (containing samples), cooling medium, and temperature monitoring device in mini-cooler. Seal mini-cooler. Prepare and attach shipping label.

r. Ship mini-cooler(s) to contract laboratory via preferred carrier. (Preferred shipping is negotiated with the contract analytical laboratory at the start of each contract period.)

NOTE: Steps 6.s through and including 6.cc (below) are performed by contract analytical laboratory personnel.

s. Upon receipt, open each mini-cooler received and record the minimum and maximum shipping temperature from the enclosed temperature monitoring device(s), and log in each sample.

t. Condition exposed filter elements.

u. Remove exposed filter elements from cassettes.

v. Determine gross weights of the exposed filter elements.

w. Perform all required Quality Assurance/Quality Control (QA/QC) activities.

x. Calculate net weight (i.e., weight of fine particulate).

y. Ensure that all required Quality Assurance/Quality Control (QA/QC) activities have been performed.

z. Calculate results, ensure that data flags have been assigned, process data, and prepare reports.

aa. Transmit data in AQS format to KDHE/BAR. This is to be performed at least once per month.

bb. Store samples at 4^{o}C for a period of at least one (1) year.

cc. Contact KDHE/BAR prior to discard of samples stored for more than one (1) year.

J. Laboratory Procedures

1. The KDHE contract analytical laboratory performs microgravimetric analysis according to the procedures specified in 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere. The contractor also performs all procedures specified in EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12, or equivalent, with the approval of the Bureau of Air and Radiation (KDHE/BAR).

2. The contract laboratory will follow applicable portions of paragraph IV.I above.

3. The contract laboratory will provide a QA Project Plan (QAPP) for approval by KDHE. The contract laboratory will follow their QAPP and applicable SOPs.

4. The contract laboratory will provide concentration data and flags if appropriate. A list of flags is shown in Appendix E below. It should be noted that these flags do not necessarily conform to EPA AQS flags. Also, a flag does not necessarily indicate invalid data.

K. Receipt, Inspection and Acceptance of $PM_{2.5}$ Equipment

This procedure will describe the method for receipt, inspection, and acceptance of $PM_{2.5}$ equipment.

1. Summary of Method

   a. The KDHE and local partner agency field technical staff are responsible for the receipt, inspection and acceptance of all $PM_{2.5}$ equipment.

   b. Each Partisol-Plus Model 2025 sampler is assembled and prepared for operation in accordance with the "Quick Start Guide" provided by the manufacturer.

   c. Each Partisol-Plus Model 2025 sampler is evaluated in accordance with the "Test and Acceptance Guide" provided by the manufacturer.

   d. For samplers purchased under the National Contract for the Purchase of $PM_{2.5}$ Monitoring Equipment, an EPA "Testing and Acceptance Criteria" form will be completed. A copy of this form will be provided (e.g., Faxed) to the appropriate EPA Headquarters contact along with the Serial Number of each instrument being accepted.

   e. Unless problems with a sampler are encountered, inspection and acceptance will be completed within 10 working days of receipt.

2. Health and Safety Warnings

   a. General safety precautions related to electrical hazards must be observed at all times when working with electronic equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electronic equipment in wet conditions, as frequently encountered at field monitoring sites.

   b. Persons operating the R&P Partisol-Plus Model 2025 Sequential Air Sampler or cleaning the WINS impactor should review the Material Safety Data Sheet (MSDS) for the WINS impactor oil.

   c. General precautions for working with heavy equipment, and electro/mechanical equipment with moving parts should be taken.

3. Cautions

   a. Although field equipment is manufactured to withstand environmental extremes, it is still precision equipment with relatively fragile electronic and mechanical parts. All field equipment used for environmental measurements should be handled with care.

4. Personnel Qualifications

   a. Persons evaluating the operation of the R&P Partisol-Plus Model 2025 Sequential Air Sampler must be familiar with the operation of electro/mechanical equipment.

   b. Working familiarity with the R&P Partisol-Plus Model 2025 operating system and software are essential for programming the sampler and for problem diagnosis and troubleshooting.

   c. Working familiarity with electronic and mechanical test equipment is required.

5. Equipment

   a. Volt/Ohm test meter (VOM)

   b. Laptop computer

   c. Hand tools

   d. Barometer & thermometer standards

   e. R&P "Test and Acceptance Guide"

6. Testing and Acceptance Procedure

   a. At the time of delivery, sign appropriate freight documentation to acknowledge receipt.

   b. Transport equipment to an appropriate secure holding area, or take directly to the Monitoring and Planning Section shop.

c. Carefully unpack each shipping container, and inspect the contents for damage and/or missing parts/items.

d. Assemble each R&P Partisol-Plus Model 2025 Sequential Air Sampler, and prepare it for operation in accordance with the "Quick Start Guide" provided by the manufacturer.

e. Conduct acceptance testing for each Partisol-Plus Model 2025 sampler in accordance with the "Test and Acceptance Guide" provided by the manufacturer.

f. For each sampler, complete and initial a copy of the "Test & Acceptance Guide" identified by the sampler serial number. Document values and pass/fail for external and internal leak checks on the back of the guide. Also document any minor repairs or adjustments made during the acceptance phase.

g. Evaluate problems with individual samplers as they occur, and take appropriate corrective actions or perform repairs as required in accordance with the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual. Report delays in acceptance to the Ambient Air Analysis Unit Supervisor. For samplers purchased under the National Contract for the Purchase of $PM_{2.5}$ Monitoring Equipment, the supervisor relays relevant information to the EPA Headquarters contact. If a specific problem is not readily solved, KDHE and/or local partner agency technical staff contact the manufacturer (R&P) for technical assistance.

h. When all steps in the "Test and Acceptance Guide" have been successfully completed, forward the information to the Ambient Air Analysis Unit Supervisor. For samplers purchased under the National Contract for the Purchase of $PM_{2.5}$ Monitoring Equipment, an EPA "Testing and Acceptance Criteria" form (see below) must be completed. A copy of this form will be provided (e.g., FAXed) to the appropriate EPA Headquarters contact along with the Serial Number of each sampler being accepted.

i. The EPA "Testing and Acceptance Criteria" form appears in Appendix D below.

V. Quality Control

A. The operator will run one (1) field blank for each ten (10) exposed filters sent to the contract analytical laboratory. Field blank results shall be reported with the monthly sample results, and shall be reported to AQS.

B. Replicate weighings and laboratory blanks are required. The KDHE contract analytical laboratory performs all QA/QC procedures specified in 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere. The contractor also performs all QA/QC procedures specified in EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12, or equivalent, with the approval of the Bureau of Air and Radiation (KDHE/BAR).

C. KDHE conducts an annual inspection and audit of the analytical laboratory performing microgravimetric analysis of $PM_{2.5}$ samples collected within the Kansas Ambient Air Monitoring Network. The KDHE inspector may participate in a group audit in cooperation with other State $PM_{2.5}$ programs which utilize the same contractor.

1. Scope and Application

a. Microgravimetric analysis of $PM_{2.5}$ filter elements from samplers operating in the Kansas Ambient Air Monitoring Network is performed by a laboratory under contract with the Kansas Department of Health and Environment (KDHE). The contract specifically provides for one (1) KDHE Bureau of Air and Radiation (KDHE/BAR) employee to perform one (1) site visit during each year of the life of the contract with expenses for travel and lodging covered by the contractor. The purpose of this annual site visit is to provide an opportunity to conduct an inspection/audit for evaluation of overall laboratory performance of work as specified in the contract. Additional inspections/audits at KDHE expense are not precluded, and the United States Environmental Protection Agency (EPA) may also conduct similar activities independent of KDHE.

b. The contractor is to conduct analysis of $PM_{2.5}$ filter elements in accordance with EPA's regulatory requirements (contained in 40 CFR 50, Appendix L) and section 2.12 of volume II of EPA's

Quality Assurance Handbook for Air Pollution Measurement Systems (or equivalent procedures if approved by KDHE/BAR). This inspection/audit is intended to assure that the contract laboratory complies with this primary contractual specification.

2. Summary of Method

a. The contractor is notified of the impending inspection by telephone, a date is agreed upon, and the date is confirmed in writing.

b. Round-trip travel arrangements are made.

c. Subsequent to arrival at the laboratory, an initial interview is conducted with appropriate laboratory management and staff personnel to explain the reason for the visit and outline the inspection/audit process.

d. The inspection and audit are conducted. The "Checklist for Inspection and Audit of Contract Laboratory for Microgravimetric Analysis of $PM_{2.5}$ Filter Elements" (Appendix B below) is completed on site during the course of the inspection/audit. Open communication with laboratory staff during these activities is essential.

e. An exit interview is conducted, and a preliminary summary of findings is presented to laboratory management personnel by the inspector.

f. A summary of findings and recommendations for any necessary corrective actions are included in a report.

g. A copy of the report is sent to appropriate contract laboratory management personnel. Written documentation of corrective actions taken by the laboratory is requested.

h. Written documentation of corrective actions is provided to KDHE/BAR by the contract laboratory.

3. Health and Safety Warnings

   a. Laboratory safety practices which minimize exposure to various chemical, electrical, and other hazards are warranted.

4. Cautions

   a. The inspector will be accompanied by laboratory personnel during the inspection.

   b. Open two-way communication is essential.

5. Personnel Qualifications

   a. The inspector will have a basic understanding of quality assurance and quality control (QA/QC) as applied in an analytical laboratory.

   b. Work experience and/or training in analytical laboratory procedures will be helpful.

6. Equipment

   a. Clipboard

   b. Ballpoint Pen

   c. "Checklist for Inspection and Audit of Contract Laboratory for Microgravimetric Analysis of $PM_{2.5}$ Filter Elements" (Appendix B below)

   d. Notepad

7. Inspection and Audit Procedure

   a. Contact the appropriate contract laboratory personnel by telephone or e-mail and establish a tentative date for the inspection and audit.

   b. Follow up by mail with a written notification confirming the date of the inspection and audit.

c. Make round-trip travel arrangements.

d. At least five (5) days prior to the laboratory visit, reconfirm the date by telephone or Email.

e. Upon arrival at the laboratory facility, conduct an initial interview with appropriate management and staff (technical and clerical) personnel. Brief them concerning the reason for the visit, and explain the inspection/audit process.

f. Conduct the inspection and audit using the "Checklist for Inspection and Audit of Contract Laboratory for Microgravimetric Analysis of $PM_{2.5}$ Filter Elements" (Appendix B below). Maintain open communication with all appropriate laboratory personnel. During the inspection/audit, make detailed notes to accompany the checklist.

g. The checklist will provide the structure for the course of the inspection and audit. The following are to be evaluated:

(1) Analytical facility and weighing room

(2) Microgravimetric balance performance

(3) Microgravimetric balance maintenance

(4) Filter conditioning

(5) Filter handling

(6) Filter weighing

(7) Record keeping and calculations

(8) Laboratory Quality Assurance Plan

h. Conduct an exit interview with appropriate laboratory management personnel. Present a preliminary summary of findings. The checklist will be signed by both parties (i.e., the inspector and the appropriate laboratory manager). Present laboratory management with a copy of the signed checklist.

i. Upon return from the inspection/audit trip, review the checklist and additional notes taken during the laboratory inspection/audit.

j. Prepare a written report containing a summary of findings and recommendations for corrective actions for deficiencies noted.

k. Mail a copy of the report with a cover letter to appropriate laboratory management personnel. In the cover letter, be sure to establish a time frame for correction of noted deficiencies and request written documentation of corrective actions taken by the laboratory.

l. Review the documentation of corrective actions provided by laboratory management.

m. If deficiencies are not addressed or appear to persist, address relevant issues in writing, and request additional documentation. (Resolution of severe deficiencies may necessitate another laboratory visit. Because of the contractual agreement, payment for expenses may have to be negotiated.)

n. Upon approval of laboratory performance, send a letter to appropriate laboratory management personnel.

o. A copy of the inspection and audit report and copies of all relevant correspondence are to be reviewed and filed by the Data Manager.

p. The "Checklist for Inspection and Audit of Contract Laboratory for Microgravimetric Analysis of $PM_{2.5}$ Filter Elements" appears in Appendix B below.

VI. Preparation and Analysis of Samples in the Field

See paragraph IV (Sampling Operations) above.

VII. Transport, Transferring and Storing Samples

A. Chain-of-Custody

1. These filter elements are quite fragile, and $PM_{2.5}$ samples must be protected from contamination and/or analyte loss which may affect

analytical results. Special handling is required to ensure the integrity of these samples.

2. The bag custody label is used to document the filter ID, the cassette ID, the expiration date, the site ID, the sampler ID, the sample date, the sample volume, sampling elapsed time, status, and comments.

3. Cautions

   a. Damage to the $PM_{2.5}$ sampler may result if caution is not taken to properly install and maintain the device. Follow the manufacturer's instructions for maintenance of the sampler and for handling of Teflon filter elements.

   b. Teflon filter elements are fragile. Handle with care, and never use damaged filter elements for sample collection.

   c. $PM_{2.5}$ samples are subject to contamination which may affect analytical results. Field personnel should not handle filter elements directly, but only when loaded in filter cassettes. Care must be taken to prevent exposure to sources of particulate matter at all times other than sampling.

   d. $PM_{2.5}$ samples are subject to loss of sample resulting from volatilization of certain chemical species; and/or physical loss of particulate matter. Sample loss due to volatilization is generally controlled by maintaining exposed filter elements at cool temperatures. Temperature control during handling and shipping is extremely difficult, but exposure to elevated temperatures should be avoided. Physical loss of particulate matter generally results from careless handling of exposed filter elements. This may result from dropping or jarring of cassettes as well as from abrasion of the filter element. Care should be taken to prevent accidental loss of particulate matter.

   e. Cigarette smoke is a known source of fine particulate matter. All activities associated with filter handling, transport, and operation of $PM_{2.5}$ airborne particulate samplers shall be conducted in a smoke free environment.

4. Equipment

   a. Rupprecht & Pataschnick Partisol-Plus Model 2025 Sequential Air Sampler

   b. $PM_{2.5}$ Teflon filter elements 47mm in diameter. Each should be housed in an appropriate filter cassette.

   c. Rupprecht & Pataschnick compatible Palmtop Data Acquisition System (PDAS) or equivalent or laptop computer, appropriate connecting hardware, and appropriate R&P communications and data management software.

   d. (Electro) static-free bags with labels for filter cassettes

   e. Mini-cooler with reusable cooling medium and internal temperature monitoring device

   f. Internal (secondary) container to hold and protect samples in mini-cooler.

   g. Ball point pen

5. Custody Procedure

   a. A clean (preweighed) batch of filters is received from the contracting laboratory. A packing list is enclosed. The packing list has the contracting laboratory address, the name of the contact person at the operator's agency, the shipping date, the number of filters, and the ID number of each filter.

   b. Each clean filter (in its cassette) is in a plastic bag. The plastic bag has a custody label affixed to it. The filter ID number, the cassette ID number, and the filter expiration date ("use before" date) have already been entered on the bag custody label by the contracting laboratory.

   c. The operator assigns each filter to a sampler, run date and whether or not it is a blank. The operator enters in a log the sampler ID, filter ID, cassette ID, blank or not, and the planned run date.

d. In the remaining portion of this procedure, take the actions stipulated according to the operator's manual. The filters (in their cassettes) are put into a filter cassette magazine so that they will run in order of the log entries above. Attach this magazine to the left-hand (supply) side of the monitor. For each filter added to the magazine, enter filter ID, blank or not, and cassette ID into the monitor to match the log entries above.

e. After the monitor has sampled, the operator downloads data from the monitor. When picking up the filters, the operator verifies that the filters in the right-hand (storage) filter cassette magazine match the log entries above or the downloaded data.

f. Using the log, and/or the monitor screens, and/or the downloaded data, the operator fills in the following on the bag custody label: site ID, sampler ID, sample date, sample volume, sampling elapsed time, status, and comments (if any). Put each filter cassette in the appropriate plastic bag with sample side of filter toward custody label (affixed to the bag).

g. The operator records the pickup date and any comments in the log.

h. The operator ships the filters every two weeks as specified by the contracting laboratory.

B. Further instructions to be followed are found in paragraph IV.I above.

VIII. Data Acquisition and Processing

The procedure in paragraph IV.A of Section 4 (above) will be followed.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

See these paragraphs of Section 9 of this document: III.A.2, III.B.2, III.C.6, IV.E, IV.H.3, IV.I.4, IV.K.6, V.C.6, and VII.A.4.

Section 10

CERTIFICATION OF STANDARDS

I. Overview

This section describes procedures for the certification of standards. These standards are used for calibrating and auditing air monitors. These standards are in the form of gaseous standards and flow standards. Gaseous standards are in the form of cylinders of gas, permeation tubes, and ozone photometers. Flow standards are in the form of PM_{10}/TSP orifice calibration standards and $PM_{2.5}$ Streamline Flow Transfer Standards.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

A. Certification of Gases

1. Zero-air

a. For SO_2, NO_2, O_3, zero-air is provided by a pressurized ozonated charcoal scrubber.

b. For SO_2, H_2S or NH_3, activated charcoal is an option to provide zero-air.

c. For CO, two methods are allowed: a catalytic oxidizer or zero gas cylinder.

2. Pollutant Gases

For continuous analyzers, standard pollutant gases utilized for calibrations, span checks, precision checks, and performance audits must be traceable to National Institute of Standards and Technology (NIST) gaseous Standard Reference Materials (SRM) or Traceable Reference Materials (NTRM). The certification of cylinders of gas are performed by the manufacturer according to EPA Traceability Protocol for Assay and

Certification of Gaseous Calibration Standards 1997 (EPA Protocol Gases).

a. CO Certification

CO (balance gas air) cylinders are purchased as EPA Protocol Gases.

b. NO_2 Certification

The NO cylinders and NO_2 permeation tubes are purchased as EPA Protocol Gases. In a QC procedure in which an NO cylinder is used, the known NO_2 is established by Gas Phase Titration (GPT) in the following manner:

A span check is performed on the NO channel. After this is complete, ozone is then mixed with the NO from the cylinder, this causes NO_2 to be produced ($NO+O_3 = NO_2+O_2$). The difference between the NO monitor readings before and after this mixing is used as the concentration of NO_2 produced.

c. O_3 Transfer Standard Certification

At least every 12 months, the KDHE primary standard photometer is compared with the EPA Region VII primary standard photometer. The KDHE primary standard is maintained in the air monitoring shop. Transfer standard photometers are periodically compared with the KDHE primary standard. One transfer standard is designated for audits; the other standards are used for non-audit QC operations. When a transfer standard is used, it has been compared with the primary standard within the previous three months. All comparisons with the primary standard require at least three calibration points. Records of all comparisons are kept on file.

d. SO_2 Certification

All SO_2 cylinders and SO_2 permeation tubes are purchased as EPA Protocol Gases.

e. H_2S Certification

The permeation rates of the H_2S permeation tubes are certified traceable to NIST standards by gravimetric analysis.

f. NH_3 Certification

The permeation rates of the NH_3 permeation tubes are certified traceable to NIST standards by gravimetric analysis.

C. HiVol Orifice Calibration Unit Certification

1. Purpose

TSP and PM_{10} Flow Certification: Each orifice calibration unit shall be calibrated USEPA Region 7's Roots meter (in Kansas City, KS) every twelve (12) months.

2. Frequency of Certification

Orifice calibration units are certified at approximate twelve (12) month intervals.

3. Equipment

a. Orifice calibration unit

b. Roots meter

c. Connectors

4. Certification Procedure

a. Connect the orifice to the inlet of the Roots meter. Connect a HiVol to the outlet side of the Roots meter.

b. Check for leaks by temporarily clamping both manometer lines (to avoid fluid loss) and blocking the orifice. Start the HiVol and note any change in the Roots meter reading. The reading should remain constant. If the reading changes, locate any leaks by listening for a whistling sound and/or retightening all connections, making sure that all gaskets are properly installed.

c. Turn off the HiVol. Unblock the orifice. Unclamp both manometer lines and zero both manometers.

d. Record the date, the orifice ID, the person's name doing the calibration, and the Roots meter ID on the orifice calibration form. Record the room temperature in degrees Celsius. Record the barometric pressure (P) in millimeters of Mercury (Hg).

Calculate T = degrees C + 273.
Calculate F = (P/760) * (298/T). Record T and F on the orifice calibration form.

e. Achieve five different but constant flow rates, evenly distributed, over the entire range of the calibrator.

f. Repeat steps g. through p. below for each flow rate. Allow the system to run for at least one minute in order for a constant motor speed to be attained.

g. Simultaneously read the Roots meter reading and start a stop watch. Record the Roots meter reading at the start of the stop watch as VI.

h. While the air is still flowing, read and record the Roots meter inlet pressure manometer in inches of Hg as PI.

i. While the air is still flowing, read and record the orifice manometer reading in inches of water as H.

j. After at least 200 cubic feet of air have passed through the Roots meter at a constant rate, simultaneously read the Roots meter reading and stop the stop watch. Record the Roots meter reading when the stop watch was stopped as VF.

k. Calculate and record VM = VF - VI.

l. Record the elapsed time from the stop watch in hundredths of a minute as TE.

m. Record PR = PI * 25.4.

n. Record VS = VM * ((P-PR)/760) * (298/T).

o. Record QS = VS / TE.

p. Record square root (H * F).

q. Using spreadsheet software, perform a linear regression with the independent variable being the square root of (H * F) and the dependent variable being QS. Using the resulting slope and intercept, build a table of (H*F) and the corresponding QS.

r. Each orifice will be calibrated once per year.

D. The Streamline Flow Transfer Standard (FTS)

The Streamline Flow Transfer Standard (FTS) is sent to the manufacturer for annual re-certification. The FTS is used in the field to calibrate $PM_{2.5}$ intermittent monitors.

E. Calibration of the Barometric Pressure Transfer Standard (BPTS)

1. Purpose

The BPTS is an aneroid barometer that is used in the field for $PM_{2.5}$ intermittent monitor pressure sensor calibration. The BPTS is also used during PM_{10}/TSP intermittent monitor flow calibrations and audits. The following procedure is used to calibrate the BPTS.

2. Summary of Method

a. KDHE maintains a National Institute of Standards and Technology (NIST) - traceable aneroid barometer as the authoritative standard (i.e., reference barometer).

b. The reference barometer is visually inspected before a transfer standard is compared to it.

c. The KDHE pressure calibration chamber shall be used to perform a three (3) point pressure verification/calibration annually. All verification checks are maintained in a log, and results are provided to the Data Manager/QA Officer.

d. A multipoint pressure verification/calibration will be performed:

(1) annually;

(2) on new transfer standards;

(3) when a transfer standard differs from the reference standard by more than $\pm$3 mm Hg during a single point verification;

(4) when a transfer standard has been dropped, or other damage is suspected; and/or

(5) if a transfer standard has been modified or repaired.

3. Cautions

a. Barometers are sensitive to sudden temperature changes. Allow the temperature of the barometer to equilibrate before making a comparison reading.

b. Always read an aneroid barometer when it is in the same position (i.e., horizontal or vertical) as when it was calibrated.

4. Personnel Qualifications

a. Persons conducting pressure verification or calibration must be trained in the use of the specific apparatus required.

b. Persons qualified to perform pressure verification or calibration must be familiar with common methods for the determination of barometric pressure.

5. Equipment

a. Reference (aneroid) barometer

b. Transfer standard barometer(s)

c. Log book for verification data

d. Calibration form

e. Clipboard and pen

f. Reference barometer correction and conversion data tables

g. Pressure calibration chamber

6. Multi-point Barometric Pressure Transfer Standard Verification/Calibration Procedure

a. Inspect the reference barometer for physical damage prior to use. Replace if damaged.

b. Allow time for temperature equilibration.

c. Compare transfer standard barometer with reference barometer at ambient conditions.

d. If the transfer standard barometer is adjustable, adjust to match the reference barometer.

e. Place the transfer standard barometer(s) and the reference barometer in the pressure calibration chamber in such a manner that all dials are clearly visible through the glass in the access door.

f. Tighten clamping screws to seal chamber access door.

g. Repeat procedure as necessary to achieve agreement with reference barometer within $\pm$1 mm Hg. If transfer barometer is not adjustable, record pressure readings.

h. Connect pressure/vacuum source to chamber, and adjust pressure to approximately 690 mm Hg equivalent on reference barometer. Record pressure readings.

i. Repeat step h above for pressures of 715, 760, and 780 mm Hg. Record pressure readings.

j. Compute a best fit curve for the transfer standard barometer. Transfer standard barometers exhibiting a non-linear relationship or a difference of more than $\pm$5 mm Hg for any point will be repaired or replaced.

F. Calibration of the Temperature Transfer Standard (TTS)

1. Purpose

The TTS is a minthermometer that is used in the field for $PM_{2.5}$ intermittent monitor temperature sensor calibration. The TTS is also used during PM_{10}/TSP intermittent monitor flow calibrations and audits. The following procedure is used to calibrate the TTS.

2. Summary of Method

a. National Institute of Standards and Technology (NIST)-traceable minithermometers, certified annually by EPA, are maintained as temperature transfer standards.

b. The reference minithermometers are visually inspected before comparison with a sampler sensor.

3. Health and Safety Warnings

a. General safety precautions related to electrical hazards must be observed at all times when working with electronic equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electronic equipment in wet conditions, as frequently encountered at field monitoring sites.

b. The electronic minithermometer probe is sharp. Use care in handling and transporting. Keep the minithermometer in its carrying case except when in use.

c. No temperature standards or devices containing mercury will be used.

4. Cautions

a. The electronic mimithermometer standard has a sharp probe. Use caution in transporting and handling.

b. The minithermometer is a precision electronic instrument. Do not drop. Handle with care.

5. Personnel Qualifications

a. Persons conducting temperature verification or calibration must be trained in the use of the specific apparatus required.

b. Persons qualified to perform temperature verification or calibration must be familiar with common methods for the determination of temperature.

6. Equipment

NIST-traceable minithermometer

7. Temperature Transfer Standard Calibration Procedure

a. The calibration has been performed by or for the manufacturer of each minithermometer.

b. The operator or supervisor maintains a copy of certification of NIST-traceability for each minithermometer used.

c. Inspect each minithermometer for physical damage prior to use for comparison to temperature sensors.

d. Each minithermometer will be compared annually to a reference at EPA Region 7.

e. Replace any minithermometer which has been damaged.

G. BIOS Dry-Cal Flow Standard Certification

The BIOS Dry-Cal flow standards are sent to the manufacturer every two years for re-certification and software updates.

H. Troubleshooting

All troubleshooting related to standards is performed in accordance with the appropriate manufacturer's manual.

IV. Collection of Data Including Operating Procedures

This is not applicable because there is no sampling involved. Procedures for certification are described in paragraph III above.

V. Quality Control Sampling

This is not applicable because there is no sampling involved.

VI. Preparation and Analysis of Samples in the Field

This is not applicable because there is no sampling involved.

VII. Transporting, Transferring, and Storing Samples

All certifications performed in-house are documented by recording the date, the person, person's initials, the standard ID, the primary standard ID, the standard readings, and the primary standard readings. Outside-house certifications are documented by a certificate from the company performing the certification. In-house documentation is submitted to the Data Manager for filing. Outside-house certifications are filed by the operator or his/her supervisor.

VIII. Data Acquisition and Processing

Paper records of certifications are filed by the Data Manager, the operator, or the operator's supervisor.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

See paragraphs III.C.3, III.E.5, and III.F.6 above.

Section 11

OZONE MAPPING SYSTEM

I. Overview

Ground-level ozone, a major component of smog, can exhibit an adverse impact on human respiratory health. People who live in communities which have a potential for elevated ozone levels can use timely, accurate information to make informed personal decisions concerning protection of their health and to know when to take actions to reduce local ozone levels.

The United States Environmental Protection Agency (U.S. EPA) created the Environmental Monitoring for Public Access and Community Tracking (EMPACT) program to utilize new technologies to provide environmental information to the general public in near real-time. One of the largest EMPACT projects is the Ozone Mapping Project, which utilizes frequently updated monitoring data to generate maps that provide communities with current information about ozone pollution in an easy-to-understand, color-coded format. These maps are created from hourly ozone data gathered from ozone monitoring networks across the country, and their color-coded contours indicate the relative level of health concern based upon the current ozone concentrations.

This procedure is to be used by Monitoring and Planning personnel to poll data loggers and transfer resultant continuous ozone data to the AIRNOW website maintained by the United States Environmental Protection Agency (EPA): http://www.epa.gov/airnow/ . This SOP is intended to be used for procedural guidance and is not intended to supersede equipment manufacturer's manuals or procedures.

II. Technical Qualifications

A. Computer skills are required for transfer and management of data.

B. Experience in remote data transfer via modem is required.

C. Familiarity with Agilaire, LLC software is required.

D. Ozone Mapping System (OMS) data management/processing personnel must have AIRNOW upload access.

E. The data management/processing trainee is required to read the following:

1. Ambient Air Monitoring Criteria Pollutants Monitoring Program Quality Assurance Program Plan in Kansas, Kansas Department of Health and Environment, Division of Environment, Bureau of Air and Radiation, Monitoring and Planning Section, Topeka, KS;

2. E-DAS Ambient for Windows Reference Manual, version 5.5, July 2005 (or latest updated version); and

3. Other applicable printed materials as available.

F. The data management/processing trainee observes an experienced trainer perform the data processing procedures. The trainee is encouraged to ask any questions that may arise.

G. The trainee performs the procedures while under the observation of an experienced trainer. The trainer offers constructive criticism in regard to the trainee's performance.

H. The trainee continues to perform under observation until the trainer is satisfied that the trainee is following the correct procedures.

I. In addition, any accessible training courses provided by EPA are to be attended for continuing education.

III. Calibration and Troubleshooting

See Section 1 of the AAM SOP.

IV. Collection of Data Including Operating Procedures

See paragraph VIII below.

V. Quality Control Sampling

See Section 1 of the AAM SOP.

VI. Preparation and Analysis of Samples in the Field

This is not applicable.

VII. Transport, Transferring, and Storing Samples

Data is transmitted electronically. See paragraph VIII below.

VIII. Data Acquisition and Processing

A. Summary of Method

1. Data is retrieved in an electronic format from data loggers in the field through the use of telephone connections and modems. In special circumstances (e.g., data logger failures, no telephone service to site, etc.) data may be retrieved on site using a lap top computer.

2. Data loggers are polled via modem connection at scheduled times.

3. Hourly ozone and continuous $PM_{2.5}$ values are transferred via modem connection to a central desktop computer.

4. Raw ozone and continuous $PM_{2.5}$ values are transferred from the desktop system to the EPA AIRNOW website.

B. Data Processing Procedure

1. KDHE collects and submits ozone and continuous $PM_{2.5}$ to the Ozone Mapping System (OMS) throughout the year. Refer to the E-DAS Ambient for Windows Reference Manual and Agilaire Ozone Mapping System User's Manual for a detailed description of software set-up and operation. Also, see Section 3 of the AAM SOP.

2. Schedule polling times for OMS sites. Monitors are polled hourly on Central Standard Time (CST).

   a. Set the polling computer to poll the appropriate ozone and continuous $PM_{2.5}$ monitor(s) at one hour intervals, continuously.

b. Set the transfer computer, which sends the data to the EPA AIRNOW website via the Data Collection Center (DCC), to transfer the data at one hour intervals.

3. Automated QA/QC checks are performed at the DCC prior to generation of maps. Steps 4 through 8 are beyond the control of the Monitoring and Planning Section.

4. Any sites reporting which are not in the DCC active reporting station file are not mapped.

5. A check for missing hours of data is performed.

6. Range and rate-of-change data are evaluated. “Suspect” data are plotted; “severe” values are not plotted.

7. If a single hourly value is missing, a linear interpolation is performed between the preceding and following values to estimate the value for the missing hour.

8. Time zones are standardized.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

A. Data logger(s) connected to continuous ozone monitor(s)

B. Modems

C. Desktop personal computer (PC)

D. Agilaire E-DAS Ambient for Windows software

E. Agilaire OMS software module

F. Internet connection to AIRNOW

Section 12

ANALYZER/INSTRUMENT SELECTION, ACCEPTANCE, AND INSTALLATION

I. Overview

Analyzers, samplers, and instruments must meet certain criteria to be considered for purchase and ultimately utilized. This procedure is intended to define those criteria and provide guidance for final acceptance and installation.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

IV. Collection of Data Including Operating Procedures

A. Selection Criteria

1. All air monitoring data will be obtained through the use of reference or equivalent methods (REMs) for all pollutants having REMs designated by USEPA. REMs are defined in 40 CFR 50.1.

2. Continuous monitoring instrumentation employed for criteria pollutant monitoring shall conform to criteria contained in 40 CFR 58, Appendix C.

3. All instrument operators shall follow procedures outlined in specific manufacturers' operational manuals supplemented by AAM SOP.

B. Acceptance Criteria

1. Following unpacking and assembly of any new monitoring instrument, an initial calibration shall be performed to confirm that the instrument is operating properly.

2. Instrument performance characteristics such as response time, noise, short-term zero and span drift, and precision shall be measured during or subsequent to initial calibration.

3. Acceptance of the instrument shall be based upon results of these performance tests. Results will be compared to published instrument specifications if such exist.

C. Installation

1. Monitoring site selection shall be in accordance with the purpose of the monitoring. Siting criteria for instruments and/or instrument probes are contained in 40 CFR 58, Appendix E.

2. Specific instrument requirements (e.g., electrical service requirements) may limit site selection.

3. Once physical siting requirements have been accommodated, installation should be conducted in accordance with specific manufacturer's recommendations and instructions.

4. Following installation, the instrument shall be recalibrated prior to actual use. Required QC procedures shall then be performed on schedule.

D. PM2.5 Acceptance Criteria

Additional requirements for $PM_{2.5}$ sequential intermittent samplers can be found in Section 9, paragraph IV.K above.

V. Quality Control Sampling

This is not applicable.

VI. Preparation and Analysis of Samples in the Field

This is not applicable.

VII. Transport, Transferring, and Storing Samples

This is not applicable.

VIII. Data Acquisition and Processing

This is not applicable.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

This is variable and depends on the situation.

Section 13

CORRECTIVE ACTION

I. Overview

This procedure is intended to provide guidance for action to be taken based upon unacceptable QC results.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

See paragraph IV below.

IV. Collection of Data Including Operating Procedures

A. Invalidation of Data

1. The operator of each monitor shall notify the Data Manager to void any data when there is good reason to suspect that the data are inaccurate.

2. Data shall be invalidated by the Data Manager based upon span checks according to the following rules:

a. If any span checks exceed 25 percent difference, then the data going back to the last valid span check will be invalidated.

b. If there are missing span checks (required every two weeks), apply the following rules when invalidating:

i. More than one span check missing, causes invalidation back to the good (less than or equal 15% difference) span check.

ii. A span check from 16-25% difference (with no recalibration), counts as missing.

iii. An audit with the span point less than or equal to 15% difference, counts as a good span check.

iv. A good span check that is greater than 5 weeks after or before any other span checks does not validate any data.

v. A calibration with a span point less than or equal to 15% difference, counts as a good span check.

3. Data may be invalidated by the Data Manager based on audits or failure to adhere to the provisions of the QAPP and/or SOPs.

4. The Data Manager will maintain supporting documentation of invalidation.

B. Recalibration: Zero and span drift checks are performed regularly (at least every two (2) weeks) on continuous analyzers to determine whether recalibration is necessary. Interpretation of zero and span check results and corrective actions are detailed in AAM SOP Section 1 above.

1. When recalibration is required, potential operational problems must be investigated and required maintenance performed prior to recalibration.

2. Repeated calibration failures may necessitate removal of the instrument for diagnostic evaluation and repair.

C. Audit Failures: Results of annual performance audits are <u>not</u> used as sole criteria for data validation, because these audits are required only once per year for each analyzer. These audits, however, provide an indication of the accuracy of monitoring data.

1. The cause of any audit deviation of more than 15% from the actual value will be investigated.

2. A QC check (precision check, zero and span) shall be performed **immediately** following an audit failure for validation of the failure. Corrective action will be taken subsequent to the QC check.

3. Instrument maintenance, repair, and/or recalibration will be performed as indicated.

4. Causes for reporting errors (i.e., wrong units, decimal place, etc.) will be investigated, and procedures developed to minimize the recurrence of such errors.

D. Equipment/Instrument Malfunction: Any deficiency in equipment/instrument performance discovered in the course of routine operation or during quality control procedures must be noted on the appropriate maintenance log sheet. Within the manufacturer's guidelines, the defective equipment/instrument may be serviced in the field, returned to the shop for repair, or returned to the manufacturer for repair or replacement. If available, a back-up instrument shall be utilized during the interim to minimize loss of data.

Data obtained during a malfunction shall be evaluated in order to determine the effect of any malfunction on data quality. Affected data will be invalidated at the discretion of the Data Manager.

E. Staff Performance Problems: In the event that Monitoring and Planning Section staff exhibit(s) difficulty with a given procedure, additional training shall be provided. Modification of procedure(s) for clarity may be beneficial.

F. $PM_{2.5}$ Intermittent Sampler Problems

1. If audits or verifications exceed 4%, the sampler is investigated and corrected, then recalibrated.

2. If the flow rate exceeds ±5% for greater than 5 minutes, a W flag is assigned in AQS.

3. If the flow rate exceeds ±10% for more than 1 minute, the data is invalid.

4. If the filter temperature exceeds the ambient temperature by more than 5°C for more than 30 minutes, an X flag is assigned in AQS.

5. If the coefficient of variation of flow rate is greater than 2%, the data may be voided.

6. If the sample period is less than 23 hours or greater than 25 hours, the data is invalid. There is an exception: if the sample period is less than 23 hours and the concentration determined by dividing the net weight by the volume (in cubic meters), that would have resulted had the sampler run for 24 hours (this is usually close to 24 cubic meters), gives a concentration greater than 15.4 micrograms per cubic meter, then that concentration is submitted to AQS with a Y flag. If this calculation yields 15.4 micrograms per cubic meter or less, then the data is invalid.

7. If the sampler runs on the wrong date, the data is valid. But the data does not count as valid when calculating percent completeness.

8. Any data affected by exceptional events (fires, construction, etc.) will be flagged according to the AQS flags listed in the AQS system.

9. If the sample is not collected from midnight to midnight (±1 hour), it is invalid. (Note: Sampling is conducted on the basis of Standard Time throughout the year.)

10. If the lab analysis followed exposure by more than 10 days and the sample was exposed to temperatures greater than 4°C, than the data is flagged by the lab as HT, but it is valid.

11. If the lab analysis followed exposure by more than 30 days, than the data is flagged by the lab as HT, but it is valid.

12. If the sample period followed tare analysis by more than 30 days, the data is flagged by the lab as XT, but it is valid.

13. If the sample temperature exceeded 25°C after removal from the sampler, the data is flagged by the lab as ST, but it is valid.

14. If the sample is not removed from the sampler within 177 hours of the end of the sample period, the data is flagged by the lab as SR, but it is valid.

15. If the associated lab blank mass change exceeds ±15 micrograms, the data is flagged by the lab as LB, but it is valid.

16. If the associated field blank mass change exceeds ±30 micrograms, the data is flagged by the lab as FB, but it is valid.

17. If the mean equilibration temperature prior to weighing is outside the range of 20°C to 23°C, the data is flagged by the lab as LC, but it is valid.

18. If the mean equilibration relative humidity prior to weighing is outside the range of 30% to 40%, the data is flagged by the lab as LC, but it is valid.

19. If the equilibration time prior to weighing is less than 24 hours for exposed samples, the data is flagged by the lab as EQ, this data is invalid.

20. If the working standard balance check is ±3 micrograms from the certified value, the data is flagged by the lab as BC, but it is valid.

21. If there is contamination (e.g., insects or debris) on the filter, the data is flagged by the lab as CN, this data is invalid.

22. If there is a sampler malfunction such that the sampler did not run, the data is flagged by the lab as MM, this data is invalid.

23. If the filter is damaged, the data is flagged by the lab as FD, this data is invalid.

24. If the filter had a negative mass gain, the data is flagged by the lab as NM, this data is invalid.

G. When a quality control (QC) action results in an indication of a problem, the following corrective action steps are taken:

1. Perform a visual inspection of the monitor for any malfunctions. Review the QC and maintenance logs for indication of a possible problem. Review recent data for unusual patterns. If a problem is defined, then repair or replace the monitor. If a monitor problem can not be pin-pointed, then continue with the following steps.

2. In cases where a known concentration standard or flow rate standard has been used, an investigation is carried out in order to determine if the standard is in error. This includes inspecting the calibration or certification documentation of the standard, checking the previous results

of the standard when compared to other monitors, and inspecting the standard equipment for malfunctions. If the standard is in error, then repair or replace it. If a standard problem can not be found, then continue with the following steps.

3. Audit the monitor using a different standard.

4. In the case of collocated particulate matter samples which have a discrepancy, request that the laboratory check their data entry and/or reweigh the filters.

5. If nothing definitive has been found up to this point, cross-check the monitor, standard and procedure with other equipment/staff. If the problem remains undefined, then perform a multi-point calibration of the monitor. Future results (data and QC) from the monitor in question shall be evaluated in detail.

V. Quality Control Sampling

This is not applicable.

VI. Preparation and Analysis of Samples in the Field

This is not applicable.

VII. Transport, Transferring, and Storing Samples

This is not applicable.

VIII. Data Acquisition and Processing

This is not applicable.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

This is variable.

Section 14

CONTINUOUS $PM_{10}/PM_{2.5}$ MONITORING; TEOM 1400 SERIES

I. Overview

This section describes the procedures for the calibration, operation, and maintenance of a TEOM 1400 Series continuous $PM_{10}/PM_{2.5}$ monitor. Specific technical considerations and complete operating instructions are included in the operation manual provided by the manufacturer. The Tapered Element Oscillating Microbalance (TEOM) 1400 Series is manufactured by Rupprecht & Patashnick.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

A. Calibrations

1. Perform the flow controller calibration (software) every six months. Follow the "Flow Controller Calibration (Software)" instructions in the Operating Manual.

2. Perform the analog output calibration every 12 months shortly prior to the flow controller calibration (hardware) below. Follow the instructions in the "Procedures for Analog Calibration" section of the Operating Manual.

3. Perform the flow controller calibration (hardware) every 12 months shortly after the analog output calibration above.

   a. Follow the instructions in the "Flow Controller Calibration (Hardware)" Section of the Operating Manual.

   b. Follow the appropriate section of the Operating Manual for the appropriate type or brand of Flow Controller.

B. Troubleshooting

Following troubleshooting instructions in the Operating Manual.

IV. Collection of Data Including Operating Procedures

A. Safety note: General safety precautions related to electrical hazards must be observed at all times when working with electrical equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electrical equipment in wet conditions, as frequently encountered at field monitoring sites. Electrical equipment should be switched off and disconnected prior to servicing of internal parts.

B. Principle and Applicability: This method employs a gravimetric principle. Ambient air is drawn through a $PM_{10}/PM_{2.5}$ inlet at a constant flow rate, continuously weighing a glass filter element upon which the particulate matter is deposited. Mass concentrations are calculated at ten (10) minute intervals, and the instrument is capable of providing not only total mass accumulation, but also 30-minute, 1-hour, 8-hour, and 24-hour averages of the mass concentration. The use of a hydrophobic filter element (i.e., Teflon-coated borosilicate glass) together with warming of the air stream to 50 degrees C, eliminates the necessity for humidity equilibration. Data retrieval is accomplished by periodically downloading from a digital data logging device to a portable computer or via a data logger and modem.

C. Installation and Assembly

1. Place the sensor unit on a sturdy bench in an R & P shelter or indoors, maintaining an ambient temperature between 50 and 86 degrees F.

2. The sample line extends vertically up from the sensor unit through the roof to the $PM_{10}/PM_{2.5}$ inlet which is mounted on a tripod on the roof.

3. The control unit is located indoors with the sensor unit.

4. Assemble the instrument following the instructions given in the Operating Manual ("Assembling the Series 1400 Monitor").

5. Follow the instructions for "Installing the Flow Splitter and $PM_{10}/PM_{2.5}$ Inlet" in the Operating Manual.

6. When transporting the sensor unit, follow the instructions for "Transporting and Shipping the Sensor Unit" in the Operating Manual.

7. Connect the monitor directly to the data logger if available.

D. Sample Filter Installation and Exchange

1. Follow the instructions for "Sample Filter Installation and Exchange" in the Operating Manual.

2. Do NOT handle new filter cartridges with fingers. Use the filter exchange tool provided with the instrument.

3. Keep sample pump running during the filter exchange.

4. Open sensor unit door. Complete the filter exchange as rapidly as possible to minimize temperature fluctuation.

5. Open the filter holding mechanism.

6. Filter removal

   a. Carefully insert the lower fork of the filter exchange tool under the filter cartridge so that the filter disk is between the fork and upper plate of the tool. The tines of the fork should straddle the hub of the filter base.

   b. Gently lift the filter from the tapered element with a straight pull. Never twist or apply sideways force to the tapered element.

7. New filter installation

   a. Place a new filter in the exchange tool so that the filter disk lies between the fork and upper plate of the tool. The hub of the filter should be positioned between the tines of the lower fork. Do NOT touch the filter with your fingers - use the tool.

b. Hold the exchange tool in line with the tapered element, and gently insert the hub of the filter onto the tip of the tapered element. Ensure that the filter is seated properly, and then apply a downward pressure of approximately one-half (0.5) Kg to set it in place.

c. Remove the filter exchange tool by retracting it sideways until it clears the filter.

8. Close the mass transducer. Allow the springs to pull it closed for the last centimeter until metal-to-metal contact is audible. DO NOT ALLOW THE MASS TRANSDUCER TO SLAM SHUT FROM THE FULL OPEN POSITION.

9. Close and latch sensor unit door.

10. Wait five (5) minutes, and open the sensor unit and mass transducer again. Press straight down on the filter cartridge with the bottom of the exchange tool. This ensures proper seating of the filter cartridge after it has experienced an increase in temperature. Close the mass transducer and the sensor unit door.

11. Reset the instrument by pressing <F1> or <RUN> on the control unit keypad.

E. System Operation and Data Storage

1. Follow the instructions for "System Operation and Data Storage" in the Operation Manual.

2. To turn the instrument on:

a. Supply power at the appropriate voltage.

b. Press the POWER button on the front panel of the Control Unit. A screen appears on the four-line display showing the name of the instrument. Soon after, the main screen will appear.

c. Turn on the pump to initiate air flow through the system.

3. Determine the average temperature (only if required by the Operating Manual).

    a. Using the nearest National Weather Service Station (NWSS), determine the average temperature for the current month.

    b. On or about January 1, or at the next scheduled site visit, set the average temperature to the January average.

    c. Repeat Step b. for each month.

4. Determine the average pressure (only if required by Operating Manual).

    a. Using the nearest NWSS, determine the annual average station barometric pressure (PN) in inches of Mercury (Hg).

    b. Determine the elevation of the NWSS (EN) and the elevation of the site (ES) in feet.

    c. Calculate the average pressure in atmospheres at the site (PS):

    $$PS = (PN + ((EN-ES)/1000)) / 29.92$$

5. On those monitors that require it, enter average temperature and pressure as described in the Operating Manual.

6. To turn the instrument off:

    a. Press the POWER button on the front panel of the Control Unit. The four-line display will become blank.

    b. Turn off the vacuum pump to terminate air flow.

    c. Disconnect the instrument from its power supply.

7. As an option, the unit may be operated using an IBM AT-compatible personal computer. If desired, follow the instructions for "Viewing Operations with a Computer" in the Operating Manual.

F. Analog Outputs

Set the analog outputs according to "Analog Inputs and Outputs" in the Operating Manual.

G. Downloading Stored Data to a Computer (not required if data logger and modem are used)

1. Connecting to a Computer

a. Connect an IBM AT-compatible computer to an RS-232 port using the 9-to-9 pin computer cable provided with the instrument. If the computer has a 25 pin RS-232 port, use the 9-to-9 pin computer cable in combination with the 9-to-25 pin computer adapter provided with the monitor. Be sure that the unused RS-232 port on the instrument is not attached to any cable or device.

b. Execute a communications program (e.g., TEOMCOMM; see section 6.5 of the operation manual) to prepare for the download.

c. Ensure that the communications software is set for the same communication parameters as the instrument. The default settings of the monitor are: 9600 baud, 8 bit word length, 1 stop bit, and NO parity. See Appendix C.2 if it is suspected that these instrument parameters have been changed.

d. Set the communications software to the appropriate mode (e.g., "Data Capture").

e. Change the RS-232 mode on the control unit to the desired setting using the "Set RS-232 Mode" screen.

i. If using a two-way RS-232 protocol, enter the appropriate parameters in the "Com 2-way Settings" screen.

ii. If using the TEOMCOMM software, select the "AK Protocol" from the "Set RS-232 Mode" screen, and enter the following values on the four lines of the "Com 2-way Settings" screen:

RS-Para 1	52
RS-Para 2	75048
RS-Para 3	13010
RS-Para 4	0

f. Test the connection by checking that the data can be sent and retrieved using the commands appropriate to the selected RS-232 protocol.

2. Downloading Stored Data to the RS-232 Port

a. Follow the steps in Section 6.3 (Downloading Storage to the RS-232 Port) of the Operating Manual.

b. Connect an appropriate personal computer to the RS-232 port.

c. Select the "Fast Store Out" mode from the "RS-232 Mode" screen. The internal logger begins to transmit data via the RS-232 port IMMEDIATELY once the mode is chosen; to capture all desired data, it is thus important to connect the computer PRIOR to selecting the "Fast Store Out" mode.

d. The monitor will transmit all stored data from the present location of the storage-to-print pointer (usually where the last download left off) through the last value stored in the internal data logger.

e. When the end of the storage buffer is reached, return the instrument to a different RS-232 mode (e.g., "None" mode) to locate the storage-to-print pointer just after the last data record transmitted. This ensures that the next download will begin where the previous one left off.

f. The location of the storage-to-print pointer can be set manually. This can be accomplished from any RS-232 mode by bringing the "View Storage" screen onto the four-line display (press <Store>). Use the navigational keys to display the record at which the pointer should reside, and then press <Ctrl><Last/First> to locate the pointer just before this record.

3. The instrument also has the capability for connection via a modem as described in the operation manual (Connecting to a Computer Through a Modem).

4. The instrument may also be connected to a data logger, using the analog I/O port and selecting the appropriate program register code (PRC).

H. Maintenance

1. The routine maintenance procedures for the instrument are summarized below:

	Procedure	Interval
a.	Clean $PM_{10}/PM_{2.5}$ inlet	Each TEOM filter change
b.	Replace fine particulate filters	6 months or when loaded
c.	Change sample flow in-line filter	6 months
d.	Change by-pass flow in-line filter	6 months
e.	Clean air inlet system	6 months
f.	Leak test	1 year

2. Follow the instructions for "Periodic Maintenance" in the Operating Manual.

3. Keep a written record of these maintenance actions.

V. Quality Control Sampling

A. Audits

1. Perform the mass transducer calibration verification every 12 months. Follow either one of the procedures for "Mass Transducer Calibration Verification" in the Operating Manual.

2. Perform the flow audit procedure every six months. Follow the instructions for "Flow Audit Procedure" in the Operating Manual. As part of this audit, perform the leak check as described in the Operating Manual. When a flow audit is performed, performance of a temperature and pressure check is also recommended.

B. Precision Check (Flow)

Perform a one point flow rate check at least once every four weeks at the normal flow of the monitor. Use an external flow standard as the known flow and the monitor flow meter as the monitor reading.

VI. Preparation and Analysis of Samples in the Field

See paragraph IV above.

VII. Transport, Transferring, and Storing Samples

See paragraph IV above.

VIII. Data Acquisition and Processing

Usually data is acquired using a data logger and modem. This procedure is described in section 1 and 3 (above) of this document AAM SOP. When a data logger and modem are not available, paragraph IV.G above are followed to download data. These data are brought to the office. Data processing procedures are described in section 4 (above) of this document AAM SOP.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

A. TEOM Continuous $PM_{10}/PM_{2.5}$ Monitor

B. TEOM Teflon-coated glass filter cartridges

C. Filter cartridge exchange tool

D. Portable computer system for data retrieval if needed

E. Tool kit

Section 15

CONTINUOUS $PM_{2.5}$ MONITORING; FDMS 8500 SERIES

I. Overview

This section describes the procedures for the calibration, operation, and maintenance of a Filter Dynamics Measurement System (FDMS) 8500 Series continuous PM_{10}/$PM_{2.5}$/PM_1 monitor. The Series 8500FDMS Monitor consists of three basic components: the 8500 module, TEOM Series 1400a sensor unit, and the TEOM Series 1400a control unit. Specific technical considerations and complete operating instructions are included in the operation manual provided by the manufacturer. The Filter Dynamics Measurement System (FDMS) 8500 Series is manufactured by Thermo Electron (formerly Rupprecht & Patashnick).

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

A. Calibrations

1. Perform the flow controller calibration (software calibration) every six months. Follow the instructions ("Flow Controller Calibration (Software)") in the Operating Manual.

2. Perform the analog output calibration every 12 months shortly prior to the flow controller calibration (hardware calibration) below. Follow the instructions ("Procedures for Analog Calibration") in the Operating Manual.

3. Perform the flow controller calibration (hardware calibration) every 12 months shortly after the analog output calibration above.

   a. Follow the instructions ("Flow Controller Calibration (Hardware)") in the Operating Manual.

B. Troubleshooting

Following troubleshooting guides in the Operating Manual.

IV. Collection of Data Including Operating Procedures

A. Safety note: General safety precautions related to electrical hazards must be observed at all times when working with electrical equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electrical equipment in wet conditions, as frequently encountered at field monitoring sites. Electrical equipment should be switched off and disconnected prior to servicing of internal parts.

B. Principle and Applicability: This method employs a gravimetric principle. Ambient air is drawn through a $PM_{10}/PM_{2.5}$ inlet at a constant flow rate, continuously weighing a glass filter element upon which the particulate matter is deposited and calculating near real-time mass concentrations. The instrument computes the 1-hour, 8-hour, 12-hour and 24-hour averages of the mass concentration. There are five air stream flows in the FDMS Series 8500 Monitor: the main flow, base flow, reference flow, bypass flow and the purge flow. Details of each flow are outlined in the operating manual ("Theory of Operation"). Data retrieval is accomplished by periodically downloading from a digital data logging device to a portable computer.

C. Installation and Assembly

1. Place the sensor unit on a sturdy bench in an R & P shelter or indoors, maintaining an ambient temperature between 50 and 86 degrees F.

2. The sample line extends vertically up from the sensor unit through 8500 module and through the roof to the $PM_{10}/PM_{2.5}$ inlet which is mounted on a tripod on the roof.

3. The control unit is located indoors with the sensor unit.

4. Assemble the instrument following the instructions given in the Operating Manual ("Hardware Installation for the Series 8500 Monitor").

5. Follow the instructions in the Operating Manual ("Installing the Flow Splitter and $PM_{10}/PM_{2.5}$ Inlet").

6. Connect the monitor directly to the data logger if available.

D. Sample Filter Installation and Exchange

1. Follow the instructions in the Operating Manual ("Sample Preparation").

2. Do NOT handle new TEOM filter cartridges with fingers. Use the filter exchange tool provided with the instrument.

3. Keep sample pump running during the filter exchange.

4. Open sensor unit door. Complete the filter exchange as rapidly as possible to minimize temperature fluctuation.

5. Open the filter holding mechanism.

6. TEOM Filter removal

   a. Carefully insert the lower fork of the filter exchange tool under the filter cartridge so that the filter disk is between the fork and upper plate of the tool. The tines of the fork should straddle the hub of the filter base.

   b. Gently lift the filter from the tapered element with a straight pull. Never twist or apply sideways force to the tapered element.

7. New TEOM filter installation

   a. Place a new filter in the exchange tool so that the filter disk lies between the fork and upper plate of the tool. The hub of the filter should be positioned between the tines of the lower fork. Do NOT touch the filter with your fingers - use the tool.

   b. Hold the exchange tool in line with the tapered element, and gently insert the hub of the filter onto the tip of the tapered element. Ensure that the filter is seated properly, and then apply a downward pressure of approximately one-half (0.5) Kg to set it in place.

   c. Remove the filter exchange tool by retracting it sideways until it clears the filter.

8. Close the mass transducer.

9. Close and latch sensor unit door.

10. Wait five (5) minutes, and open the sensor unit and mass transducer again. Press straight down on the filter cartridge with the bottom of the exchange tool. This ensures proper seating of the filter cartridge after it has experienced an increase in temperature. Close the mass transducer and the sensor unit door.

11. Reset the instrument by pressing <F1> or <RUN> on the control unit keypad.

12. 47 mm filter installation

    a. Install a new 47 mm filter every time the TEOM filter is replaced.

    b. Open the 8500 module unit door. Disconnect the quick-connect fitting from the filter holder. Unscrew the filter holder form the chiller. Remove the blue filter cassette from the holder. Separate the cassette halves and replace the filter paper. Press the cassette back together and install into the holder with the filter paper facing away from the holder (the paper will be visible, not the support screen). The cassette will snap into place. Screw the holder back into the chiller and connect the quick-connect fitting. Close the small filter door.

E. System Operation and Data Storage

1. Follow the instructions in the Operating Manual ("Basic Operation").

2. To turn the instrument on:

    a. Supply power at the appropriate voltage.

    b. Press the POWER button on the front panel of the Control Unit. A screen appears on the four-line display showing the name of the instrument. Soon after, the main screen will appear.

    c. Turn on the pump to initiate air flow through the system.

3. To turn the instrument off:

   a. Press the POWER button on the front panel of the Control Unit. The four-line display will become blank.

   b. Turn off the vacuum pump to terminate air flow.

   c. Disconnect the instrument from its power supply.

4. As an option, the unit may be operated using an IBM AT-compatible personal computer. If desired, follow the instructions in the Operating Manual ("Using RPComm").

F. Analog Outputs

Set the analog outputs according to the Operating Manual ("Data Inputs and Outputs").

G. Downloading Stored Data to a Computer (not required if data logger and modem are used)

1. Connecting to a Computer

   a. Connect an IBM AT-compatible computer to an RS-232 port using the 9-to-9 pin computer cable provided with the instrument. If the computer has a 25 pin RS-232 port, use the 9-to-9 pin computer cable in combination with the 9-to-25 pin computer adapter provided with the monitor. Be sure that the unused RS-232 port on the instrument is not attached to any cable or device.

   b. Execute a communications program (e.g., RPCOMM; refer to the Operating Manual) to prepare for the download.

   c. Ensure that the communications software is set for the same communication parameters as the instrument. The default settings of the monitor are: 9600 baud, 8 bit word length, 1 stop bit, and NO parity.

d. Set the communications software to the appropriate mode (e.g., "Data Capture").

e. Change the RS-232 mode on the control unit to the desired setting using the "Set RS-232 Mode" screen.

i. If using a two-way RS-232 protocol, enter the appropriate parameters in the "Com 2-way Settings" screen.

ii. If using the RPCOMM software, select the "AK Protocol" from the "Set RS-232 Mode" screen.

f. Test the connection by checking that the data can be sent and retrieved using the commands appropriate to the selected RS-232 protocol.

2. The instrument also has the capability for connection via a modem as described in the Operation Manual ("Connecting to a Computer Through a Modem").

H. Maintenance

1. The routine maintenance procedures for the instrument are summarized below:

	Procedure	Interval
a.	Clean PM_{10}/$PM_{2.5}$ inlet	Each TEOM filter change
b.	Clean Sharp Cut Cyclone	2 weeks or as needed
c.	Replace fine particulate filters	6 months or when loaded
d.	Change sample flow in-line filter	6 months
e.	Change by-pass flow in-line filter	6 months
f.	Clean switching valve	Each TEOM filter change or as needed
g.	Clean air inlet system	1 year or as needed

h. Rebuild sample pump — 18 months or as needed

i. Leak test — 1 year

2. Follow the instructions in the Operating Manual ("Routine Maintenance").

3. Keep a written record of these maintenance actions.

V. Quality Control Sampling

A. Audits

1. Perform the mass transducer calibration verification every 12 months. Follow the procedure in the Operating Manual ("Verification Procedures").

2. Perform the flow audit procedure every six months. Follow the instructions in the Operating Manual ("Flow Audit Procedure"). As part of this audit, perform a leak check.

B. Precision Check (Flow)

Perform a one point flow rate check at least once every four weeks at the normal flow of the monitor. Use an external flow standard as the known flow and the monitor flow meter as the monitor reading.

VI. Preparation and Analysis of Samples in the Field

See paragraph IV above.

VII. Transport, Transferring, and Storing Samples

See paragraph IV above.

VIII. Data Acquisition and Processing

Usually data is acquired using a data logger and modem. This procedure is described in section 1 and 3 (above) of this document AAM SOP. Data processing procedures are described in section 4 (above) of this document AAM SOP.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

Section 16

SITE/SYSTEMS INSPECTION AND RECORDS AUDIT

I. Overview

Local Health Departments (LHDs) which conduct ambient air quality monitoring activities under Memoranda of Agreement (MOAs) with the Kansas Department of Health and Environment (KDHE) are evaluated to verify that the terms of their respective MOAs and annual workplans are being fulfilled. The KDHE Air Monitoring Unit is also subject to these internal evaluations. Periodic physical inspection of continuous and intermittent samplers/monitors is conducted in order to verify that proper maintenance is being performed and that the samplers are in acceptable operating condition. Additional physical inspection of monitoring equipment will also be conducted in the event that AMU field personnel note evidence of poor maintenance or neglect of equipment located at any monitoring site.

With prior notification, each local health department which participates in ambient air quality monitoring activities under an MOA with KDHE is visited by MPS personnel. It is preferable that the MPS send one (1) QA/QC person and one (1) field technician as an audit team. Files are checked for consistent documentation of quality assurance. Equipment maintained by the LHD is inspected *in situ*, preferably in the company of appropriate LHD personnel (or, in the case of a KDHE site, the field technician with primary responsibility for that site), to verify that it is being maintained in safe and acceptable operating condition. Any immediately evident problems are discussed with the LHD personnel (or appropriate KDHE field technician) as they are noted. A summary of the findings and any recommendations for corrective action are included in a report. A copy of the report is provided to the appropriate personnel.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

This not applicable.

IV. Collection of Data Including Operating Procedures

A. Site Audit Procedure

1. Notification

   a. Contact the appropriate LHD or KDHE personnel by telephone or in person and establish a tentative date for the site audit.

   b. Follow up by mail with a written notification to the appropriate LHD/KDHE supervisor.

      i. If possible, provide at least two weeks notice.

      ii. State that a site audit has been tentatively scheduled for the date negotiated.

      iii. Enclose a copy of the "Air Quality Monitoring Checklist for Site/Systems Inspection and Records Audit" to facilitate preparation for the audit. (See Appendix C below.)

2. Records Audit

   a. Upon initiation of the audit, obtain a copy of the completed checklist.

   b. Use the checklist in conjunction with the "Site/Systems Inspection and Records Audit Checklist" for review of QA records. (See Sec. E. below.)

      Note: Steps i. – iv. below refer to "LHD"; all apply for KDHE sites and equipment.

      i. If the LHD is responsible for calibrations, verify that complete and up-to-date calibration information is on file. Recommend development of a written calibration schedule if not in use.

      ii. If the LHD is responsible for performance audits, verify that complete and up-to-date audit information is on file. Recommend development of a written audit schedule if not in use.

      iii. If the LHD is responsible for calibrations and/or performance audits, verify that a complete and up-to-date list of all standards and equipment used for such purposes, together with copies of manufacturers' certifications for permeation tubes and cylinders of compressed gases is on file.

iv. Verify that complete and up-to-date maintenance information is on file. Recommend development of a written preventive maintenance schedule if not in use.

3. Physical inspection of Monitoring Equipment

Note: This inspection may also be performed on **any** equipment in the Kansas Ambient Air Monitoring Network. It may be performed independent of an LHD/KDHE site audit.

a. Purpose

i. Periodic physical inspection of HiVol samplers is conducted in order to verify that proper maintenance is being performed and that the samplers are in acceptable operating condition. Condition of wiring is evaluated to ensure operator safety and minimize instrument down time.

ii. Continuous monitors are checked to ensure that they are powered up and recording data.

b. HiVol Sampler Site Audit

i. If possible, have at least one (1) LHD or KDHE employee directly involved in sampler operation accompany the MPS inspector(s) to the site(s) selected for equipment inspection.

ii. Conduct the inspection of equipment using the "HiVol (TSP/PM_{10}) Maintenance and Operational Checklist". Use a separate checklist form for each sampler. (See Sec. E. below.)

iii. For a PM_{10} sampler, check all hood latches for general condition, proper adjustment, and verify that all are properly engaged.

iv. For a PM_{10} sampler, inspect the shim (impaction plate) to verify that it is reasonably clean and properly lubricated.

v. For a PM_{10} sampler, inspect all gaskets (above and below shim) and note their condition. Look for evidence of leakage (e.g., "dust trails", etc.).

vi. Check the filter element cassette gasket and note its condition.

vii. Start the motor and check for even speed after a warm-up period.

viii. Inspect electrical supply lines and visible internal wiring and connections. Note their condition.

c. $PM_{2.5}$ Sampler Site Audit

i. Verify that the current date/time and the sample start date/time are correct.

ii. Verify that the cooling fans are operational and that the filters are being periodically cleaned.

iii. Inspect accessible v-seals and o-rings.

iv. Inspect the filter compartment, inlet and downtube to verify that they are reasonably clean.

v. Verify that the impactor is being properly serviced.

vi. Check the overall condition of the sampler (hinges, latches, loose screws?).

vii. Inspect power cords, conduit, receptacles and any other associated electrical hardware.

viii. Check access for safety (ladders, walkways and railings).

d. Continuous Monitor Site Audit

Note: Proper operation of continuous monitors is verified primarily by means of precision and span check procedures.

i. Verify that continuous monitor(s) are switched on.

ii. Verify that data are being recorded.

iii. Verify that the recording device is registering data at the proper times.

4. Summary Report of Findings

a. Review all checklist forms completed during the LHD/KDHE site audit.

b. Prepare a brief summary of findings.

c. Include recommendations for corrective action(s).

d. Provide copies of the report to the appropriate LHD/KDHE personnel. A copy will also be kept in an MPS file.

B. Forms Used in Conducting Local Health Department Site Audits

The forms utilized in the course of local health department site audits appear in Appendix C below.

V. Quality Control Sampling

This is not applicable.

VI. Preparation and Analysis of Samples in the Field

This is not applicable.

VII. Transport, Transferring, and Storing Samples

This is not applicable.

VIII. Data Acquisition and Processing

Paper or electronic report is sent to local health agency and also a copy is filed in the MPS.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

Site audit forms

Pen

Clipboard

Section 17

CALIBRATION OF AUXILIARY FLOW METERS

I. Overview

This section describes the procedures for calibrating auxiliary flow meters which exist on various calibration equipment. These flow meters are not used directly in measuring air pollutant concentration, but to dilute gaseous standards to appropriate concentrations for calibration of ambient air monitoring instruments. An example of this type of flow meter is a Metronics Calibrator rotameter.

II. Technical Qualifications

All personnel involved are required to have the necessary experience and training to perform this monitoring activity correctly.

III. Calibration and Troubleshooting

A. Calibration of Rotameter

1. Purpose

This procedure describes the calibration of a Metronics Calibrator rotameter using a Dry Cal DC-2 Flow Calibrator (BIOS) manufactured by BIOS International Company.

2. Procedure

a. Following the operator's manual of the Metronics Calibrator and the BIOS, assemble a BIOS in line with the rotameter, needle valve, and pump.

b. Turn on the pump.

c. Adjust the needle valve until the rotameter indicator is about 20 percent of full scale.

d. Following the BIOS operator's manual, measure the flow (standard conditions) using the BIOS. Record the rotameter reading and the BIOS flow reading.

e. Repeat the two steps immediately above for approximately 40, 60, 80, and 100 percent full scale of the rotameter.

f. Using spreadsheet software, run a regression with the rotameter readings as the first independent variable, the rotameter readings squared as the second independent variable, and the BIOS readings as the dependent variable. The resulting second degree curve will be the calibration curve. Print a table with the rotameter setting by 0.5 increments and the corresponding standard flow from the calibration curve.

3. Equipment

Rotameter, BIOS flow calibrator, needle valve, and pump.

4. Use of Other Standards

The BIOS is a primary standard. Rotameters may also be calibrated against secondary standards such as wet test meters, dry gas meters, mass flow meters, and laminar flow elements, provided these secondary standards have been calibrated against a primary standard. The method of choice will vary, depending on the rate of flow to be measured; and/or the scale or limits of the calibration standard. The choice of method should be made by a qualified technician trained in the use of these methods of calibration.

B. Calibration of a Mass-flow Meter

1. Purpose

This procedure describes the calibration of a Mass-flow Meter using a Dry Cal DC-2 Flow Calibrator (BIOS) manufactured by BIOS International Company.

2. Procedure

   a. Following the operator's manual of the Mass-flow Meter and the BIOS, assemble BIOS in line with the Mass-flow Meter, needle valve, and pump.

   b. Turn on the pump.

   c. Adjust the needle valve until the Mass-flow Meter indicator is approximately 20 percent of full scale.

   d. Following the BIOS operator's manual, measure the flow (standard conditions) using the BIOS. Record the Mass-flow Meter reading and the BIOS flow reading.

   e. Repeat the two steps immediately above for approximately 40, 60, 80, and 100 percent full scale of the Mass-flow Meter.

   f. Using spreadsheet software, run a regression with the Mass-flow Meter readings as the first independent variable, the Mass-flow Meter readings squared as the second independent variable, and the BIOS readings as the dependent variable. The resulting second degree curve will be the calibration curve. Print a table with the Mass-flow Meter setting by 0.5 increments and the corresponding standard flow from the calibration curve.

3. Equipment

   Mass-flow Meter, BIOS flow calibrator, needle valve, and pump.

C. Perform troubleshooting actions according to the applicable manufacturer's manual.

IV. Collection of Data Including Operating Procedures

This is not applicable because there is no sampling involved. Procedures for calibration are described in paragraph III above.

V. Quality Control Sampling

This is not applicable because there is no sampling involved.

VI. Preparation and Analysis of Samples in the Field

This is not applicable because there is no sampling involved.

VII. Transporting, Transferring, and Storing Samples

Calibrations are documented by recording the date, the person, person's initials, the standard ID, the flow meter ID, the standard flow readings, the flow meter readings, and calibration curve. This documentation is submitted to the Data Manager for filing.

VIII. Data Acquisition and Processing

Paper records of these calibrations are filed by the Data Manager.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

See paragraphs III.A.3 and III.B.3.

Section 18

Field Personnel Safety

I. Overview.

A. This section provides general guidance to assure the safety of Kansas Department of Health and Environment/Bureau of Air and Radiation (KDHE/BAR) personnel while conducting routine field activities.

B. This procedure is **not** intended to serve as an SOP for emergency response.

II. Technical Qualifications

A. All Air Monitoring field personnel are required to have the necessary experience and training to safely operate, maintain and repair electro/mechanical equipment and instrumentations under ambient field conditions.

B. General knowledge of basic safety practices and procedures for the following are required:

1. General electrical hazards;

2. Basic ladder safety;

3. General vehicle and towing safety; and

4. Safe handling of compressed gases

C. All Air Monitoring field personnel are required to research, present and attend presentations relating to relevant safety issues. Assignments for presentations are made among field staff on a rotational basis. Presentations are made at regularly scheduled work unit meetings. The performance goal is one safety presentation per month.

III. Calibration and Troubleshooting

This section is not applicable.

IV. General Safety Procedures

A. Air Monitoring field staff are required to operate and maintain monitoring equipment under diverse environmental conditions. Equipment may be deployed in a temperature-controlled shelter, on the rooftop of a multi-story building, or at ground level. Monitoring sites are located in both urban and rural areas. Air monitoring activities may entail obtaining a single 'grab sample' or collecting continuous data for a number of years at a dedicated monitoring site.

1. Field staff are encouraged to wear appropriate clothing during field activities to protect them from insect bites, sunburn, and/or excess heat or extreme cold exposure.

2. General precautions for working with heavy equipment, and electro/mechanical equipment with moving parts should be taken.

3. Staff should remain aware of situations where wrist watches, rings, etc., could become entangled in moving parts of equipment or tools.

4. Jewelry or other objects capable of conducting an electric current should be removed before working on equipment.

5. Field staff need to remain aware that capacitors in electronic equipment may retain a substantial charge after the device has been disconnected from the power source.

6. If a field activity must be performed during adverse weather, an additional staff member may assist in driving to and from the site. If weather conditions are very severe, field staff shall postpone or reschedule travel and inform the field staff supervisor.

7. If air monitoring activities are conducted at an industrial facility, field staff shall comply with the facility's safety plan/procedures.

B. Electrical Safety

1. General Information

General safety precautions related to electrical hazards must be observed at all times when working with electronic equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electronic equipment in wet conditions, as frequently encountered at field monitoring sites. If possible, electrical equipment should be switched off and disconnected prior to servicing of internal parts.

Workers will report all electrical shocks to a supervisor and will use their own discretion in seeking medical attention or may be required by a supervisor to seek medical attention.

a. Most electrical accidents result from:

- unsafe equipment installation:
- unsafe environment; or
- unsafe work practices.

b. Electrical shock can be prevented through the use of insulation, guarding, grounding, electrical protective devices, and safe work practices.

c. When working on electrical equipment basic procedures to follow are:

- de-energize the equipment before inspection or repair, if possible;
- use lockout/tagout procedures to ensure that the equipment remains de-energized;
- use insulating protective equipment;
- keep electric tools properly maintained;
- maintain a safe distance from energized parts;
- exercise caution when working near energized lines; and
- use appropriate protective equipment.

After transporting monitors, calibrators or other electrical equipment, check for loose circuit boards or electrical components before connecting to electric power and starting up.

2. Insulation

Before connecting electrical equipment to a power source, check the insulation of any exposed wires for defects. Insulation covering a flexible power supply cord or an extension cord, is especially susceptible to damage.

3. Tools

Appropriate and properly maintained tools help protect workers against electric hazards. Check each tool before using it. If a defect is found, immediately remove it from service and tag it so no one will use it until it has been repaired or replaced.

4. Grounding

a. Grounding a tool or electrical system means intentionally creating a low- resistance path that connects to the earth. This prevents the buildup of voltage that could cause an electrical accident.

b. Grounding is normally a secondary protective measure to protect against electric shock. It does not guarantee protection against electrical shock or injury due to an electrical current. It will, however, substantially reduce the risk, especially when used in combination with other safety measures.

c. An equipment ground helps protect the equipment operator. It furnishes a second path for the current to pass through from the tool or machine to the ground. This additional ground safeguards the operator if a malfunction causes the equipment's metal frame to become energized. The resulting flow of current may activate circuit protection devices.

d. All electric cords and receptacles shall be three-prong with ground (or four prong for 220V main power in new equipment shelters).

e. Field technicians shall carry a voltmeter and a receptacle tester to verify proper wiring connection and voltage.

f. All mobile shelters shall be grounded at the monitoring site with a standard 8 foot copper-clad ground rod, independent of any other grounding of electrical or telephone service.

5. Circuit Protection Devices

Circuit protection devices limit or stop the flow of current automatically in the event of a ground fault, overload, or short circuit in the wiring system. Well-known examples of these devices are fuses, circuit breakers, ground-fault circuit interrupters (GFCIs), and arc-fault circuit interrupters.

a. Ground-fault circuit interrupters (GFCIs) shall be used in wet locations, outdoor (including rooftop) sites, and other high-risk areas. These devices interrupt the flow of electricity within as little as 1/40 of a second to prevent electrocution. GFCIs compare the amount of current going into electric equipment with the amount of current returning from it along the circuit conductors. If the difference exceeds 5 milliamperes, the device automatically shuts off the electric power.

b. Repeated remote tripping of a GFCI by power line fluctuations may require replacement of the GFCI with a conventional circuit breaker.

6. Overhead power lines

a. Before working under or near overhead power lines, ensure a safe distance (i.e., at least 10 feet) to the lines.

b. Equipment at all monitoring stations shall be installed in a manner that maintains a safe distance to energized lines.

c. If work near energized lines is required, an observer shall be used to monitor work and warn of impending safe distance violation. Work activity shall be modified to preserve a safe working distance.

C. Basic Ladder Safety

Ladder safety begins with the selection of the proper ladder for the job and includes inspection, setup, proper climbing and standing, proper use, care, and storage. In addition to the general safety rules for all ladders there are special rules for using stepladders and for single and extension ladders. The American National Standards Institute (ANSI) requires that a duty rating sticker be placed on the side of every ladder so users can determine if they have the correct type ladder for each task.

1. Ladder Selection

a. Be sure the ladder being used has the proper duty rating to carry the combined weight of the user and the material being installed.

b. A ladder's duty rating tells you its maximum weight capacity. There are four categories of duty ratings:

Type of Ladder	Duty Rating	Approved Use
Type IA	300 pounds	Extra-heavy duty/Industrial
Type I	250 pounds	Heavy-duty
Type II	225 pounds	Medium-duty
Type III	200 pounds	Light duty

c. The sections of an extension ladder should overlap enough to retain the strength of the ladder. The usable length of the ladder is shortened by the amount of the overlap. Recommended overlap lengths appear in the following table:

Length of Ladder	Required Overlap
Up to 36 feet	3 feet
Over 36 to 48 feet	4 feet
Over 48 to 60 feet	5 feet

d. Never splice or tie two short ladders together to make a long section.

e. Top support for a ladder is as important as good footing. The top should rest evenly against a flat, firm surface. If a ladder is to be leaned against roof gutters, the strength and stability of the gutters should first be tested.

f. When a ladder is used for access to an upper landing surface, it must extend three rungs, or at least three feet above the landing surface.

g. A ladder used for access to an upper landing surface should be secured against sideways movement at the top or held by another worker whenever it is being used.

h. Extend an extension ladder only from the ground. Determine the needed height, extend and lock the fly section securely in place then set it up against the wall. Check for stability and support before climbing.

i. If possible, the base of a long ladder should be secured to the ground and the top should be tied to the upper landing surface.

j. The technically proper angle for a non-self-supporting ladder is about 75 degrees above horizontal. This means that the base should be set out one-fourth of the ladder's height to its top support point. For example, if a ladder is to be supported at a point 20 feet off the ground, its base should be set 5 feet out from the wall (20 feet divided by 4 = 5 feet). An easy way to measure this, if the ladder top will rest against the wall, is to pace off the length of the ladder or count the rungs, and divide by four to get the proper distance form the wall for placing the foot of the ladder.

k. If the job requires a ladder to be placed at an angle more or less than 75 degrees above horizontal, re-evaluate ladder selection or use an assistant to remain on the ground and provide support.

2. Ladder Inspection

a. Always check a ladder before using it. Check all ladders to see that steps or rungs are tight and secure. Be sure that all hardware and fittings are properly and securely attached. Test movable parts to see that they operate without binding or without too much free play. Inspect metal and fiberglass ladders for bends and breaks.

b. Never use a damaged ladder. Tag it "Defective" remove it from service.

c. Field staff shall regularly inspect and lubricate hinges and latches on folding ladders to assure proper operation and adjustment.

3. Ladder Setup

It is very important to learn and apply the proper methods for setting up ladders. Incorrect setup can cause damage to the ladder and excessive physical strain on the user. The following steps should be followed:

Step 1. Lay the ladder on the ground with the base resting against the bottom of the wall and the top pointing away from the wall.

Step 2. Starting at the top of the ladder, lift the end overhead and walk under the ladder to the wall, moving hands from rung to rung as you go.

Step 3. When the ladder is vertical, and the top touches the wall, pull out the base so that the distance away from the wall is about one-fourth of the height to the point of support.

Step 4. Reverse this process to take down the ladder. Check for obstacles before moving backwards. Be careful to lower the ladder slowly to maintain control.

The following also apply to proper ladder setup:

a. Place ladder feet firmly and evenly on the ground or floor. Make sure the ladder is sitting straight and secure before climbing it. If one foot sits in a low spot, build up the surface with firm material.

b. Do not try to make a ladder reach farther by setting it on boxes, barrels, bricks, blocks or other unstable bases.

c. Do not allow ladders to lean sideways. Level them before using.

d. Brace the foot of the ladder with stakes or place stout boards against the feet if there is any danger of slipping.

e. Never set up or use a ladder in a high wind, especially a lightweight metal or fiberglass type. Wait until the air is calm enough to insure safety.

f. Never set up a ladder in front of a door unless the door is locked or a guard is posted.

g. If a ladder must be used on ice or snow, use spike or spur-type safety shoes on the ladder feet and be sure they are gripping properly before climbing.

h. Use Safety shoes on ladder feet whenever there is any possibility of slipping.

4. Ladder Climbing and Standing

Use the proper size ladder for the job.

a. Keep the steps and rungs of ladders free of grease, oil, wet paint, mud, snow, ice, paper and other slippery materials. Also clean such debris off your shoes before climbing a ladder.

b. Always face a ladder when climbing up or down. Maintain three-point contact (two hands and one foot, two feet and one hand) at all times.

c. Never carry heavy or bulky loads up a ladder. Use a hand line to hoist materials or equipment. Additional personnel may be necessary to complete task safely.

d. Climb and stand on a ladder with your feet near the center of the steps or rungs.

e. Do not overreach from a ladder. Maintain control.

f. Never stand on the two top rungs of a straight or extension ladder.

5. Proper Use of Ladders

a. Use only approved fiberglass ladders near energized power lines. If the overhead power line is 50 kV or less, then stay at least 10 feet away. For everything else, keep at least 35 feet away.

b. When using a ladder where there is traffic, erect warning signs or barricades to guide traffic away from the foot of the ladder. If this is not possible, have someone hold and guard the bottom of the ladder.

c. While on a ladder, do not try to move it by rocking, jogging or pushing it away from a supporting wall.

d. Never use a ladder when under the influence of alcohol, drugs or medication, or in ill health.

e. Never leave tools or materials on top of a ladder.

f. Never push or pull anything sideways while on a ladder. This puts a side load on the ladder and can cause it to tip.

g. Allow only one person at a time on a ladder unless the ladder is specifically designed for two people.

h. Never use a ladder as a horizontal platform, plank, scaffold or material hoist.

i. Never use a ladder on a scaffold platform.

6. Proper Ladder Care and Storage

a. Maintain ladders in good condition.

b. Keep all ladder accessories, especially safety shoes, in good condition.

c. Never use a metal or fiberglass ladder which has been exposed to fire or strong chemicals. It should be discarded.

d. Never store materials on a ladder.

e. Store fiberglass ladders where they will not be exposed to sunlight or other ultraviolet light sources.

f. Be sure that ladders are properly supported and secured when in transit.

g. Store ladders on racks, which give them proper support when not in use.

h. Metal bearings of extension ladder rung locks and pulleys should be lubricated periodically, and between regular maintenance periods whenever necessary.

i. Ropes on extension ladders should be in good condition. If they become frayed or badly worn, replace them.

7. Safety Rules for Stepladders

a. Never use a stepladder over 20 feet long.

b. Always open a stepladder completely and make sure the spreader is locked open before using the ladder.

c. Never substitute makeshift devices of wire or rope for stepladder spreaders.

d. Do not stand higher than the second step from the top of a stepladder. Especially, do not stand or sit on the top cap, or stand on the pail shelf, or on the back of a stepladder.

e. Do not straddle the front and back of a stepladder.

D. Vehicle and Trailer Towing Safety

1. Vehicle Safety

a. Any person operating a vehicle on behalf of the State of Kansas must possess a valid Kansas Driver's License.

b. Any person operating a vehicle on behalf of the State of Kansas is responsible for its safe operation.

c. All Kansas vehicle laws and rules of the road must be followed when operating any vehicle.

d. It is the responsibility of the driver to properly maintain the vehicle. Tires, lights, mirrors, windshield wipers and fluid levels shall be checked regularly. If using a vehicle on a temporary basis, report defects to the assigned driver to assure that corrective action/repair is performed.

2. Trailer and Towing Safety

The following must be considered when towing a trailer:

a. Know the capacity of the trailer.

b. Do not overload the trailer. Overloading can cause serious injury or equipment damage.

c. Use a properly sized towing vehicle. Do not exceed vehicle weight or axle weight ratings.

d. Distribute weight so that trailer tongue weight is approximately 10% of the gross trailer weight (GTW). Do not let tongue weight exceed coupler and hitch rating.

e. Always use safety chains when towing. Cross safety chains under coupling to prevent tongue from dropping to ground.

f. Make sure hitch and ball are properly sized and are fully engaged. Use available locks or safety pins to secure the coupling.

g. Before departing, verify the following:

i. Tires on both the towing vehicle and the trailer are properly inflated.

ii. Trailer brake lights, turn signals and mirrors should be checked for proper operation.

iii. Double check the hitch for proper connection (and adjust brake controller if so equipped).

iv. Tow at an appropriate speed for load and weather conditions.

E. Safe Handling of Compressed Gases

General safety precautions related to the handling and use of compressed gases must be observed during the calibration and QC procedures for continuous analyzers.

1. Never expose a compressed gas cylinder to a temperature above 125^{o} F.

2. Transport compressed gas cylinders with valve protector caps in place. Remove valve protector cap only when ready to make connections.

3. Use the contents of a compressed gas cylinder only with an appropriate pressure regulator attached.

4. Keep valve pointed away from yourself and anyone else.

5. Vent and use compressed gases only with adequate ventilation.

6. Vent valve briefly to clear opening of dirt and debris before making connection.

7. After making connections, check for leaks with soapy water.

8. Close cylinder valve and release all pressure from a device before disconnecting.

9. Never apply oil to a compressed gas valve or regulator.

10. Never hammer on a cylinder valve or use excessive force in opening or closing.

V. Quality Control Sampling

This is not applicable.

VI. Preparation and Analysis of Samples in the Field

This is not applicable.

VII. Transport, Transferring, and Storing Samples

This is not applicable.

VIII. Data Acquisition and Processing

This is not applicable.

IX. Glossary of Technical Terms

See the glossary in Appendix A of this document (AAM SOP) and in Appendix A of the KDHE DOE Quality Management Plan (Part I).

X. Checklist of Field Equipment

This is variable and depends on the situation.

APPENDIX A

GLOSSARY OF TERMS

Absorption -- the process of one substance entering into the inner structure of another.

Activated Charcoal -- a highly absorbent form of carbon used to remove odors and toxic substances from liquids or gases.

Adsorption -- the adhesion of a thin film of liquid or gases to the surface of a solid substance.

Air Quality System (AQS) -- a computer-based repository of US air pollution information administered by the EPA Office of Air Quality Planning and Standards.

Air-conditioning -- the process of treating air to meet the requirements of a conditioned space by controlling its temperature, humidity, cleanliness, and distribution.

AQS (Air Quality System) -- a computer-based repository of US air pollution information administered by the EPA Office of Air Quality Planning and Standards.

Air -- So called "pure" air is a mixture of gases containing about 78 percent nitrogen; 21 percent oxygen; less than 1 percent of carbon dioxide, argon, and other gases; and varying amounts of water vapor. See also ambient air.

Air Monitoring -- Sampling for and measuring of pollutants present in the atmosphere.

Air Pollutants -- Amounts of foreign and/or natural substances occurring in the atmosphere that may result in adverse effects to humans, animals, vegetation, and/or materials. (See also air pollution.)

Air Pollution -- Degradation of air quality resulting from unwanted chemicals or other materials occurring in the air. (See also air pollutants.)

Air Quality Index (AQI) -- A numerical index used for reporting severity of air pollution levels to the public. It replaces the formerly used Pollutant Standards Index (PSI). Like the PSI, the AQI incorporates five criteria pollutants (ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide) into a single index. The new index also incorporates the 8-hour ozone standard and the 24-hour PM2.5 standard into the index calculation. AQI levels range from 0 (good air quality) to 500 (hazardous air quality). The higher the index, the higher the level of pollutants and the greater the likelihood of health effects. The AQI incorporates an additional index category, unhealthy for sensitive groups, that ranges from 101 to 150.

Ambient Air -- The air occurring at a particular time and place outside of structures. Often used interchangeably with "outdoor air." (See also air.)

Ammonia (NH3) -- A pungent colorless gaseous compound of nitrogen and hydrogen that is very soluble in water and can easily be condensed into a liquid by cold and pressure. Ammonia reacts with NOx to form ammonium nitrate, a major PM2.5 component in the Western United States.

Area Sources -- Those sources for which a methodology is used to estimate emissions. This can include area-wide, mobile and natural sources, and also groups of stationary sources (such as dry cleaners and gas stations). The federal air toxics program defines a source that emits less than 10 tons per year of a single hazardous air pollutant (HAP) or 25 tons per year of all HAPs as an area source.

Atmosphere -- 1. The gaseous mass or envelope of air surrounding the Earth. From ground-level up, the atmosphere is further subdivided into the troposphere, stratosphere, mesosphere, and the thermosphere. 2. A standard unit of pressure exerted by a 29.92 inches (760 mm) column of mercury at sea level and equal to 1000 grams per square centimeter.

Barometric pressure -- The pressure from the atmosphere without any correction to sea level.

Carbon Dioxide (CO2) -- A colorless, odorless gas that occurs naturally in the Earth's atmosphere. Significant quantities are also emitted into the air by fossil fuel combustion.

Carbon Monoxide (CO) -- A colorless, odorless gas resulting from the incomplete combustion of hydrocarbon fuels. CO interferes with the blood's ability to carry oxygen to the body's tissues and results in numerous adverse health effects. Over 80% of the CO emitted in urban areas is contributed by motor vehicles. CO is a criteria air pollutant.

Channel -- A monitored analog input line on a data logger, normally associated with data from one sensor or instrument.

Cubic feet per minute (CFM) -- The amount of air, in cubic feet, that flows through a given space in one minute.

Concatenate -- to link computer files together in a series or chain**.**

Continuous Sampling Device -- An air analyzer that measures air quality components continuously.

Concentration -- The quantity of one constituent dispersed in a defined amount of another.

Criteria air pollutant -- An air pollutant for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set. Examples include ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, PM10 and PM2.5. The term "criteria air pollutants" derives from the requirement that the U.S. EPA must describe the characteristics and potential health and welfare effects of these pollutants. The U.S. EPA periodically review new scientific data and may propose revisions to the standards as a result.

Data logger -- The data acquisition and control device that collects data from air monitoring instruments (sensors), averages it, stores it temporarily, and passes it to the office computer on request.

Desiccant -- A chemical agent that absorbs moisture.
Dilution -- A concentration made less concentrated by adding gas or liquid.

Downloading -- The process of transferring configuration information from the office computer to the data loggers.

Dust -- Solid particulate matter that can become airborne.

Emission -- Pollution discharge from a source.

Exceedance -- A measured level of an air pollutant higher than the national ambient air quality standards. (See also NAAQS.)

Exposure -- The concentration of the pollutant in the air multiplied by the population exposed to that concentration over a specified time period.

Exposure Assessment -- Measurement or estimation of the magnitude, frequency, duration and route of exposure to a substance for the populations of interest.

Fly Ash -- Air-borne solid particles that result from the burning of coal and other solid fuel.

Gas -- A state of matter in which substances exist in the form of nonaggregated molecules, and which, within acceptable limits of accuracy, satisfies the ideal gas laws.

Gravimetric -- of or relating to measurement by weight**.**

Haze (Hazy) -- A phenomenon that results in reduced visibility due to the scattering of light caused by aerosols. Haze is caused in large part by man-made air pollutants.

High efficiency particulate arrestance (HEPA) -- High efficiency air filter.

Hydrocarbons -- Compounds containing various combinations of hydrogen and carbon atoms. They may be emitted into the air by natural sources (e.g., trees) and as a result of fossil and vegetative fuel combustion, fuel volatilization, and solvent use. Hydrocarbons are a major contributor to smog.

Humidity -- The measure of moisture in the atmosphere.

Hydrogen Sulfide (H2S) -- A colorless, flammable, poisonous compound having a characteristic rotten-egg odor. It is used in industrial processes and may be emitted into the air.

Inert Gas -- A gas that does not react with the substances coming in contact with it.

Inversion -- A layer of warm air in the atmosphere that prevents the rise of cooling air and traps pollutants beneath it.

Mean -- Average.

Median -- The middle value in a population distribution, above and below which lie an equal number of individual values; midpoint.

Micron -- A unit of linear measure equal to one millionth of a meter, or one thousandth of a millimeter.

Monitoring -- The periodic (intermittent) or continuous sampling and analysis of air pollutants in ambient air or from individual pollution sources.

NAMS -- National Air Monitoring Station.

National Ambient Air Quality Standards (NAAQS) -- Standards established by the United States EPA that apply for outdoor air throughout the country. There are two types of NAAQS. Primary standards set limits to protect public health and secondary standards set limits to protect public welfare.

Negative Pressure -- Condition that exists when less air is supplied to a space than is exhausted from the space, so the air pressure within that space is less than that in surrounding areas.

NH3 – Ammonia

Nitric Oxide (NO) -- Precursor of ozone, NO2, and nitrate; nitric oxide is usually emitted from combustion processes. Nitric oxide is converted to nitrogen dioxide (NO2) in the atmosphere, and then becomes involved in the photochemical processes and/or particulate formation. (See nitrogen oxides.)

NIST -- National Institute of Standards and Technology.

Nitrogen Oxides (Oxides of Nitrogen, Nox) -- A general term pertaining to compounds of nitric oxide (NO), nitrogen dioxide (NO2), and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes, and are major contributors to smog formation and acid deposition. NO2 is a criteria air pollutant, and may result in numerous adverse health effects.

NOy -- The sum of all oxidized nitrogen species, i.e. NO, NO2, NO3, HNO3, N205, alkyl nitrates, PAN, etc. Does not include NH3 or N2O. See also nitrogen oxides, NOx.

Odor -- A quality of gases, liquids, or particles that stimulates the olfactory organ or sense of smell.

Odor Threshold -- Concentration of odorous air at which it is detected by humans.el detect the odor.

Opacity -- The amount of light obscured by particle pollution in the atmosphere. Opacity is used as an indicator of changes in performance of particulate control systems.

Organic Compounds -- A large group of chemical compounds containing mainly carbon, hydrogen, nitrogen, and oxygen. All living organisms are made up of organic compounds.

Oxidant -- A substance that brings about oxidation in other substances. Oxidizing agents (oxidants) contain atoms that have suffered electron loss. In oxidizing other substances, these atoms gain electrons. Ozone, which is a primary component of smog, is an example of an oxidant.

Oxidation -- The chemical reaction of a substance with oxygen or a reaction in which the atoms in an element lose electrons and its valence is correspondingly increased.

Ozone -- A strong smelling, pale blue, reactive toxic chemical gas consisting of three oxygen atoms. It is a product of the photochemical process involving the sun's energy and ozone precursors, such as hydrocarbons and oxides of nitrogen. Ozone exists in the upper atmosphere ozone layer (stratospheric ozone) as well as at the Earth's surface in the troposphere (ozone). Ozone in the troposphere causes numerous adverse health effects and is a criteria air pollutant. It is a major component of smog.

Ozone Layer: A layer of ozone in the lower portion of the stratosphere, 12 to 15 miles above the Earth's surface, which helps to filter out harmful ultraviolet rays from the sun. It may be contrasted with the ozone
component of photochemical smog near the Earth's surface which is harmful.

Ozone Precursors -- Chemicals such as non-methane hydrocarbons and oxides of nitrogen, occurring either naturally or as a result of human activities, which contribute to the formation of ozone, a major component of smog.

PAMS -- Photochemical Analysis Monitoring System

Parameter -- A single, monitored pollutant, meteorological parameter, or other measured entity.

Particulate Matter (PM) -- Any material, except pure water, that exists in the solid or liquid state in the atmosphere. The size of particulate matter can vary from coarse, wind-blown dust particles to fine particle
combustion products.

Photochemical Reaction -- A term referring to chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.

Photolysis -- Chemical decomposition induced by light or other energy.

Plume -- A visible or measurable discharge of a contaminant body from a given point of origin. Can be a visible body of pollution such as smoke coming from a stack or a measured amount such as heat in water coming from a power plant boiler.

PM2.5 -- A criteria air pollutant consisting of tiny particles with an aerodynamic diameter less than or equal to a nominal 2.5 microns. This fraction of particulate matter penetrates most deeply into the lungs.

PM10 (Particulate Matter 10) -- A criteria air pollutant consisting of small particles with an aerodynamic diameter less than or equal to a nominal 10 microns (about 1/7 the diameter of a single human hair). Their small size allows them to make their way to the air sacs deep within the lungs where they may be deposited and result in adverse health effects. PM10 also causes visibility reduction.

POC -- Parameter occurrence code (used in AQS to designate an additional monitor of the same parameter at the same site).

Point Sources -- Specific points of origin where pollutants are emitted into the atmosphere such as factory smokestacks.

Polling -- The collection and storage of data from a field data logger by the central office computer.

Positive Pressure -- Condition that exists when more air is supplied to a space than is exhausted, so the air pressure within that space is greater than that in surrounding areas.

ppb (parts per billion) -- The concentration of a pollutant in air in terms of volume ratio. A concentration of 1 ppb means that for every billion units of air, there is one unit of pollutant present.

ppm (parts per million) -- The concentration of a pollutant in air in terms of volume ratio. A concentration of 1 ppm means that for every million units of air, there is one unit of pollutant present.

Preventive Maintenance -- Regular and systematic inspection, cleaning, and replacement of worn parts, materials, and systems. Preventive maintenance helps to prevent parts, material, and systems failure by ensuring that parts, materials and systems are in good working order.

PTFE -- Polytetrafluoroethylene.

Reentrainment -- The deposition of particulate from the air to the soil where the particulate in the air was originally drawn in and transported by the flow of air from a source.

Relative Humidity -- Amount of water vapor in the air expressed as a percent of the maximum amount of water vapor that the air could hold at the current temperature.

Site -- An identifier for a data logger that may indicates its location.

SIP -- State Implementation Plan

SLAMS -- State/Local Air Monitoring Station

Smog -- A combination of smoke and other particulates, ozone, hydrocarbons, nitrogen oxides, and other chemically reactive compounds which, under certain conditions of weather and sunlight, may result in a murky brown haze that causes adverse health effects.

Smoke -- A form of air pollution consisting primarily of particulate matter (i.e., particles released by combustion). Other components of smoke include gaseous air pollutants such as hydrocarbons, oxides of nitrogen, and carbon monoxide. Sources of smoke may include fossil fuel combustion, agricultural burning, and other combustion processes.

Solar radiation -- The power per unit area applied to a horizontal surface due to the sun.

Soot -- Very fine carbon particles that have a black appearance when emitted into the air.

Source -- Any place or object from which air pollutants are released. Sources that are fixed in space are stationary sources and sources that move are mobile sources.

State Implementation Plan (SIP) -- A plan prepared by states and submitted to U.S. EPA describing how each area will attain and maintain national ambient air quality standards. SIPs include the technical foundation for understanding the air quality (e.g. emission inventories and air quality monitoring), control measures and strategies, and enforcement mechanisms.

Stationary Sources -- Non-mobile sources such as power plants, refineries, and manufacturing facilities which emit air pollutants.

Stratosphere -- The layer of the Earth's atmosphere above the troposphere and below the mesosphere. It extends between 10 and 30 miles above the Earth's surface and contains the ozone layer in its lower portion. The stratospheric layer mixes relatively slowly; pollutants that enter it may remain for long periods of time.

Sulfates -- (See Sulfur Oxides.)

Sulfur Dioxide (SO2) -- A strong smelling, colorless gas that is formed by the combustion of fossil fuels. Power plants, which may use coal or oil high in sulfur content, can be major sources of SO2. SO2 and other sulfur oxides contribute to the problem of acid deposition. SO2 is a criteria air pollutant.

Sulfur Oxides -- Pungent, colorless gases (sulfates are solids) formed primarily by the combustion of sulfur-containing fossil fuels, especially coal and oil. Considered major air pollutants, sulfur oxides may impact human health and damage vegetation.

Temperature -- degree of hotness or coldness measured on a definite scale.

TEOM -- Tapered Element Oscillating Microbalance, method of measuring PM2.5 or PM10 on a continuous basis.

Topography -- The configuration of a surface, especially the Earth's surface, including its relief and the position of its natural and man-made features.

Total Suspended Particulate (TSP) -- Particles of solid or liquid matter, such as soot, dust, aerosols, fumes, and mist, up to approximately 30 microns in size.

Troposphere -- The layer of the Earth's atmosphere nearest to the surface of the Earth. The troposphere extends outward about 5 miles at the poles and about 10 miles at the equator.

ug/m^3 -- Micrograms per cubic meter.

United States Environmental Protection Agency (U.S. EPA) -- The federal agency charged with setting policy and guidelines, and carrying out legal mandates for the protection of national interests in environmental resources.

USGS -- United States Geological Survey.

UV -- Ultraviolet.

Vapor -- The gaseous phase of liquids or solids at atmospheric temperature and pressure.

Vapor Pressure -- The pressure, often expressed in millimeters of mercury (mm Hg) or pounds per square inch (PSI), that is characteristic at any given temperatures of a vapor in equilibrium with its liquid or solid form.

Viscosity -- The degree to which a fluid resists flow under an applied force.

Visibility -- A measurement of the ability to see and identify objects at different distances. Visibility reduction from air pollution is often due to the presence of sulfur and nitrogen oxides, as well as particulate matter.

VOC -- Volatile Organic Compound.

Volatile -- Any substance that evaporates readily.

Volatile Organic Compounds (VOCs) -- Carbon-containing compounds that evaporate into the air (with a few exceptions). VOCs contribute to the formation of smog and/or may themselves be toxic. VOCs often have an odor, and some examples include gasoline, alcohol, and the solvents used in paints.

Welfare-Based Standard (Secondary Standard) -- An air quality standard that prevents, reduces, or minimizes injury to agricultural crops and livestock, damage to and the deterioration of property, and hazards to air and ground transportation.

Wind direction (vector average) -- The direction of the resultant vector sum of all wind observations during the hour. The direction indicates where the wind is blowing from.

Wind observation -- A vector with direction being where the wind is blowing from and magnitude equal to the wind speed.

Wind speed (vector average) -- The magnitude of the resultant vector sum of all wind observations during the hour divided by the number of observations.

WINS -- Well impactor ninety-six (the part of the PM2.5 monitor which separates the smaller than or equal 2.5 micron particles from the air).

Appendix B

CHECKLIST FOR INSPECTION AND AUDIT OF CONTRACT LABORATORY FOR MICROGRAVIMETRIC ANALYSIS OF $PM_{2.5}$ FILTER ELEMENTS

Kansas Department of Health and Environment
Bureau of Air and Radiation
CHECKLIST FOR INSPECTION AND AUDIT OF CONTRACT LABORATORY FOR MICROGRAVIMETRIC ANALYSIS OF $PM_{2.5}$ FILTER ELEMENTS

Contractor: ____

Address: ____

____

____

Auditor Name and Affiliation: ____

Audit Question	Yes	No	NA	Comments
Analytical Facility / Weighing Room:				
Is the filter preparation / weighing area neat and clean?				
Is the analytical balance located in the same controlled environment in which filters are conditioned?				
Is weighing area isolated from vibration?				
Are effective methods for neutralization of electrostatic charge employed in the weighing area?				
Is HEPA filtration of the inlet air system employed?				
Is weighing area in an interior location without windows?				
Are the following conditions for filter conditioning / weighing met as specified in 40 CFR Part 50, Appendix L?				

Mean temperature:	20-23^{o}C.
Temperature control:	$\pm$2^{o}C over 24 hours.
Average humidity:	30-40% relative humidity (RH).
Humidity control:	$\pm$5% RH over 24 hours.
Conditioning time:	Not less than 24 hours.

$PM_{2.5}$ Microgravimetric Contractor Audit Checklist (Continued).

Audit Question	Yes	No	NA	Comments
Microgravimetric Balance Performance:				
Does each analytical balance used to weigh filters have an identification number?				
Is each identification number recorded to verify weighings conducted on a specific balance?				
Does each analytical balance used to weigh filters have a readability of $\underline{+}$1ug?				
Does each analytical balance used to weigh filters have a repeatability of $\underline{+}$1ug?				
Was each balance calibrated as specified by the manufacturer at installation?				
Is each balance recalibrated immediately prior to each weighing session?				
Are regular (e.g., daily, when in use) balance calibration checks made and properly recorded?				
Are working mass standards verified against NIST-traceable primary standards at least every 6 months?				
For each balance used to weigh filters, is the weight obtained for a 200mg audit weight within $\underline{+}$50ug?				
Are non-metallic forceps used to handle mass standards?				
Microgravimetric Balance Maintenance:				
Is there a formal logbook for balance maintenance?				
Are the balance maintenance logbook entries current?				
Is the balance on a service agreement for regular professional maintenance, or is someone within the organization certified by the manufacturer to service the balance?				
Filter Conditioning:				
Are filters conditioned immediately prior to both pre- and post-sampling weighings?				

$PM_{2.5}$ Microgravimetric Contractor Audit Checklist (Continued).

Audit Question	Yes	No	NA	Comments
Filter Conditioning (Continued):				
Are filters conditioned at the same environmental conditions prior to both pre- and post-sampling weighings?				
Are new filters immediately placed in the conditioning environment and stored there until the pre-sampling weighing?				
Are filters weighed immediately following the conditioning period without intermediate or transient exposure to other environmental conditions?				
Filter Handling:				
Are powder free gloves used by the analyst?				
Are smooth, clean forceps used by the analyst?				
Are ^{210}Po strips used to neutralize electrostatic charge?				
If so, are ^{210}Po strips replaced every 6 months?				
Are filters visually inspected prior to weighing?				
Are filter numbers properly recorded and legibly written?				
Filter Weighing Procedures:				
Are both the pre- (tare) and post-sampling weighings carried out on the same analytical balance?				
Are both weighings carried out by the same analyst?				
If not, have results from the different analysts been statistically compared?				
Are pre-sampling weighings performed within 30 days prior to exposure of the filters? (Review records for evidence of filters which exceed this time span.)				

$PM_{2.5}$ Microgravimetric Contractor Audit Checklist (Continued).

Audit Question	Yes	No	NA	Comments
Filter Weighing Procedures (Continued):				
If filters are stored at ambient temperature, are the post-sampling conditioning and weighings completed within 10 days (240 hours) after the end of the sample period?				
If not, are the results appropriately flagged?				
If filters are stored at 4°C or less during the entire time between retrieval from the sampler and start of conditioning, are the post-sampling conditioning and weighings completed within 30 days after the end of the sample period?				
Are new field blank filters weighed along with the pre-sampling weighing of each lot of filters?				
Are field blank filters routinely used, observing the following steps: transport to the sampling site; install in sampler; retrieve from sampler (without sampling); and reweigh?				
Are laboratory blank filters employed to determine filter mass stability?				
Are laboratory blank filters weighed along with the pre-sampling weighing of each set of filters and reweighed when the exposed filters are received from the field? (These laboratory blank filters should remain in the laboratory in protective containers during field sampling, and should be reweighed as a QC check.)				
Is each balance rezeroed after every tenth filter weighing?				
Are reweighings performed after every tenth filter weighing?				
Record Keeping and Calculations:				
Are logbooks kept current and properly filled in?				
Are logs and/or charts of balance room temperature and humidity on file?				
Are records of shipments (incoming and outgoing) maintained?				
Are records of sample filter condition (e.g., temperature) upon arrival at the laboratory kept?				

$PM_{2.5}$ Microgravimetric Contractor Audit Checklist (Continued).

Audit Question	Yes	No	NA	Comments
Record Keeping and Calculations (Continued):				
Are data management files in order?				
Is there evidence that data validation, internal QA review, and complete data reporting have occurred?				
Is the personnel management structure sound?				
Laboratory Quality Assurance Plan:				
Does the laboratory maintain a written QA Plan?				
Is there evidence that laboratory standard operating procedures (SOPs) are employed and strictly followed by all personnel?				
Are the QA Plan and SOPs current?				

Additional Comments:

Signatures:

Inspector: ____Date:______________________________

Laboratory Manager: ____Date:_____________________________

Appendix C

Air Quality Monitoring Checklist for Site/Systems Inspection and Records Audit

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Air and Radiation
Monitoring and Planning Section
Air Quality Monitoring Checklist for
Site/Systems Inspection and Records Audit

This listing should be completed prior to inspection, and a copy of this entire form should be provided to the inspector.

I. Calibrations and Performance Audits

A. Calibrations

If responsible for calibrations of monitors, all calibration records for the preceding twelve months should be readily available at time of inspection. Photocopies of calibration records may be requested.

B. Performance Audits

If responsible for performance audits of monitors, all performance audit records for the preceding twelve months should be readily available at time of inspection. Photocopies of performance audit records may be requested.

C. Certification of Standards

If responsible for calibration and/or performance audits of monitors, a current list of all standards and equipment used for such purposes, together with copies of manufacturers' certifications for permeation tubes and cylinders of compressed gases, should be readily available at time of inspection. Photocopies of some of these materials may be requested.

II. Preventive Maintenance

Is a preventive maintenance schedule followed? Are maintenance and repair records kept in a permanent log?

Site ID	Parameter	PM Schedule (Y/N)	PM Log (Y/N)
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐
		Yes ☐ No ☐	Yes ☐ No ☐

All preventive maintenance and repair documentation for the preceding twelve months should be readily available at time of inspection. Photocopies of some materials may be requested.

III. Stack testing/CEM certification monitoring

Have stack testing (including opacity observations) and/or CEM certification activities been performed during the past year? If so, please have documentation of all such activities conducted during the preceding twelve months available at time of inspection.

IV. Training Events

Please list all training events related to Air Quality Monitoring that department personnel have attended during the preceding twelve months:

	Event	Location	Person Attending	Date
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

V. Physical Inspection of Monitoring Equipment

At least one staff member directly involved with ambient air monitoring activities should be available to accompany inspection personnel for inspection of all monitoring equipment at all monitoring sites.

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Air and Radiation
Monitoring and Planning Section

SITE/SYSTEMS INSPECTION AND RECORDS AUDIT CHECKLIST

AGENCY: ______________________________ DATE: ____________

LOCATION: ____________________________ AUDITOR: _________

CALIBRATION RECORDS	YES	NO
CALIBRATION FORMS ON FILE		
COMPLETE INFORMATION ON FORMS		
CALIBRATIONS CURRENT		
CALIBRATION SCHEDULE ON FILE		

PERFORMANCE AUDIT RECORDS	YES	NO
AUDIT FORMS ON FILE		
COMPLETE INFORMATION ON FORMS		
PERFORMANCE AUDITS CURRENT		

MAINTENANCE RECORDS	YES	NO
MAINTENANCE FORMS ON FILE		
COMPLETE INFORMATION ON FORMS		
MAINTENANCE RECORDS CURRENT		
*PREVENTIVE MAINTENANCE SCHEDULE ON FILE		

* Recommended, but not required.

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Air and Radiation
Monitoring and Planning Section

HiVol (TSP/PM_{10}) MAINTENANCE AND OPERATIONAL AUDIT CHECKLIST

SITE No.: ________________________ DATE: _________

LOCATION: ________________________ AUDITOR: ______

SAMPLER I.D.: ____________________

PM10	YES	NO
LATCHES in good working order		
LATCHES adjusted properly		
LATCHES fastened properly		
SHIM clean		
SHIM oiled		

PM10	GOOD	ACCEPTABLE	REPLACE
GASKETS hood/cover			
GASKETS above shim			
GASKETS below shim			

PM10/TSP	GOOD	ACCEPTABLE	REPLACE
GASKET cassette			
MOTOR start-up			
ELECTRIC supply line			
ELECTRIC internal			
SAFETY ladder			

COMMENTS:

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT

Bureau of Air and Radiation
Monitoring and Planning Section

PM 2.5 Site Inspection and Audit Checklist

Agency:____________ Location:___________ Site ID:____________

Date:______________ Auditor:_____________ Operator:___________

Sampler ID:________

	OK	Needs Attention	Last Maintenance
Current Date/Time	☐	☐	
Sample Start Date/Time	☐	☐	
External Fans	☐	☐	
External Fan Filters	☐	☐	
Filter Compartment	☐	☐	
Seals & O-Rings	☐	☐	
Impactor & Well	☐	☐	
Inlet & Downtube	☐	☐	
Hinges/Latches	☐	☐	
Elect. Cords, Conduit, Etc.	☐	☐	
Access (Safe ?)	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

Comments:

Appendix D

FORM FOR TESTING AND ACCEPTANCE CRITERIA OF $PM_{2.5}$ MONITORS

TESTING AND ACCEPTANCE CRITERIA	Yes	No
1. Check the enclosed packing list. Were all parts listed included in the delivery of the monitor?		
2. Were any of the enclosed parts broken during the shipping of the monitor?		
3. Check the enclosed assembly instructions. Did all parts fit together during assembly of the monitor?		
4. Does the motor turn on when supplied with electrical power?		
5. Using an independent timing mechanism, check to insure the timer operates properly. Check to see if the timer will automatically turn on and off during a set time by setting the timer to start and stop the monitor while the operator is present.		
6. Does the computer boot up and operate properly? Check to see if the computer has working software by performing manual input of information into the computer.		
7. Does the computer download information properly? Check this by manually trying to download information.		
8. Does the internal fan operate properly? Check this by supplying electrical power to the unit and checking if the fan will turn on and off.		
9. Does the temperature sensor operate properly? Check this by taking a temperature reading with the internal fan off and then with the internal fan on and checking to see if the temperature readings change.		
10. Does the filter holder apparatus operate properly? Check this by manually installing a filter into the holder apparatus and checking to see if the filter is sealed into the unit.		
11. Does the casing protect the internal unit from the weather? Check this by visually inspecting the unit's gaskets and seals for holes, leaks, etc. Note: This is a visual inspection only. Do not take apart the unit.		
12. Does the unit support structure keep the unit secure and upright?		
13. When all parts are assembled and operated together, does the unit function properly? Check this by assembling the unit as the instructions dictate, installing a filter, setting the timer, and operating the unit as a normal monitoring period.		

___________________________ (Accept / Reject)
Certifying Official

City/State:____________ Phone Number:________________

Appendix E

$PM_{2.5}$ Laboratory Sample Flags

Sample Collection Flags

Lab Code	Name	Description
FE	Flow excursion	Flow rate excursion > ± 5% for > 5 minutes
FS	Flow stop	Measured sample flow rate deviated by more than 10% from set point for more than 60 seconds
TD	Temperature difference	Measured temperature of filter exceeded the measured ambient temperature by more than 5 EC for more than 30 minutes
CV	Coefficient of variation	Coefficient of variation of flow rate greater than 2%
PI	Power interruption	Power outage of >60 sec. Occurred during sampling
CL	Calibration	Sampler calibration not valid or missing
SP	Sample period	Elapsed sample period differed by more than ±1 hour of programmed period
WD	Wrong day	Sample period does not match the schedule
FQ	Field QA	Field quality assurance requirements not met
EE	Exceptional Event	Sample affected by event (fire. etc.)
FM	Filter media	Filter media other than Teflon membrane used or in some other way does not meet RM specifications
CI	Collection Interval	Sample was not collected from midnight to midnight

Sample Handling and Analysis Flags

Lab Code	Name	Description
HT	Hold time	Gross mass analysis followed exposure by more than 10 days if sample exposed to temperatures >4 EC, or 30 days if sample maintained #4 EC
XT	Expired tare	Sample period followed tare analysis by more than 30 days
ST	Sample temperature	Sample temperature exceeded 25 EC after removal from sampler
SR	Sample removal	Sample not removed from sampler within 96 hours of end of sample period
MD	Missing data	Sample collection data missing
LB	Lab blank	Associated lab blank mass change exceeds ±15 Fg
FB	Field blank	Mass change of field blank associated with sample exceeds ± 30 Fg
LC	Lab conditions	Lab conditions outside of range during 24 hours prior to analysis (18 EC<T<22 EC, 35%<RH<45%)
EQ	Equilibration time	Equilibration time <24hrs for exposed samples, $<t_{equil}$ for tares
BC	Balance checks	Working standard balance checks out of specification (±3 Fg from certified value)

$PM_{2.5}$ Laboratory Sample Flags

Invalid Sample Codes

Lab Code	Name	Description
CN	Contamination	Contamination including observations of insects or other debris
MM	Machine malfunction	Sampler did not operate properly
FD	Filter damage	Sample filter damaged beyond recovery
MD	Missing data	Missing sample collection data
NM	Negative mass	Filter had a negative mass gain
NR	No run	Sampler did not operate, no sample collected
LE	Lab error	Lab error
OE	Operator error	Operator error
LS	Lost sample	Lost sample
VO	Void Sample	Sample voided by operator

Appendix F

SUMMARY OF $PM_{2.5}$ SAMPLER MAINTENANCE ITEMS

Frequency[a]	Maintenance Item[b]
Every five sampling days	1. Service water collector bottle. 2. Clean or change-out impactor well.
Monthly	1. Clean sampler inlet surfaces. 2. Clean impactor housing and impactor jet surfaces. Examine O-rings. 3. Clean interior of sampler case. 4. Check sampler clock accuracy. 5. Check condition of sample transport containers.
Quarterly (every three months)	1. Inspect O-rings of inlet. Remove and lightly coat them with vacuum grease. 2. Clean sampler downtube. 3. Inspect and service water seal gasket where downtube enters sampler case. 4. Remove, inspect, and service O-rings of impactor assembly. 5. Inspect and service vacuum tubing, tube fittings, and other connections to pump and electrical components. 6. Inspect and service cooling air intake and fans.
Other periodic maintenance	1. As recommended by the manufacturer's sampler manual.

[a] Frequency may vary depending on climate, amount of particulate matter in the air, weather, etc.
[b] Remove impactor and filter cassette before servicing any upstream sampler components.

This table appears as Table 9-1. in Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12.9.0, USEPA, Environmental Monitoring Systems Laboratory, Research Triangle Park, NC.

Appendix G

REFERENCES

1. 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere

2. Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. I - V, USEPA, Environmental Monitoring Systems Laboratory, Research Triangle Park, NC

3. Operating Manual: Partisol-Plus Model 2025 Sequential Air Sampler, Rupprecht & Pataschnick Co., Inc., 25 Corporate Circle, Albany, NY 12203

4. Service Manual: Partisol-Plus Model 2025 Sequential Air Sampler, Rupprecht & Pataschnick Co., Inc., 25 Corporate Circle, Albany, NY 12203

5. Ambient Air Monitoring Criteria Pollutants Quality Assurance Project Plan, Kansas Department of Health and Environment, Division of Environment, Bureau of Air and Radiation, Monitoring and Planning Section, Topeka, KS

6. Ambient Air Monitoring Standard Operating Procedures, Kansas Department of Health and Environment, Division of Environment, Bureau of Air and Radiation, Monitoring and Planning Section, Topeka, KS

7. Ambient Air Monitoring Non-Criteria Pollutants Quality Assurance Project Plan, Kansas Department of Health and Environment, Division of Environment, Bureau of Air and Radiation, Monitoring and Planning Section, Topeka, KS

8. 40 CFR 58, Ambient Air Quality Surveillance

9. 40 CFR 58, Appendix A, QA Requirements for SLAMS

10. 40 CFR 58, Appendix B, Quality Assurance Requirements for Prevention of Significant Deterioration (PSD) Air Monitoring

11. 40 CFR 58, Appendix C, Ambient Air Quality Monitoring Methodology

12. 40 CFR 58, Appendix D, Network Design for State and Local Air Monitoring Stations (SLAMS), National Air Monitoring Stations (NAMS), and Photochemical Assessment Monitoring Stations (PAMS)

13. 40 CFR 58, Appendix E, Probe Siting Criteria for Ambient Air Quality Monitoring.

14. Agilaire Ozone Mapping System User's Manual, May 1998

15. E-DAS Ambient for Windows Reference Manual, Version 5.33a, October 1999